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## ERRATA

NSA Vol. 6, No. 7, p.273. In abstract 2166, secondary No. U-2066 should be U-20664.

NSA Vol. 8, No. 12A, p.453. In abstract 3799, secondary No. T-4/8 should be T-4/B.



## BIOLOGY AND MEDICINE

## RADIATION EFFECTS

## 2966 MLM-1057

Mound Lab., Miamisburg, Ohio.

THE EFFECTS OF INJECTED ACTINIUM EQUILIBRIUM MIXTURE ON RATS AND MICE. W. P. Jolley, D. Roesch, R. Horne, and D. S. Anthony. June 15, 1955. 5p. Contract AT-33-1-GEN-53.

The effects on rats and mice injected with  $\text{Ac}^{227}$ , which is in equilibrium with its daughter elements, is described. Single and multiple intravenous injections over a range of doses were investigated as to the effects on the animals which are attributable to Ac. The lowest effective doses were determined. Bone tumor incidence was proved to be the most sensitive criterion of radiation damage. The results are extrapolated to determine the maximum permissible concentration of Ac in man. (auth)

## 2967 UCLA-359

California. Univ., Los Angeles. Atomic Energy Project. ENDOGENOUS HISTAMINE EXCRETION IN THE RAT AS INFLUENCED BY X-RAY IRRADIATION AND COMPOUND 48/80. James L. Leitch, Virginia Debley, and Thomas J. Haley. Jan. 30, 1956. 27p. Contract AT-04-1-GEN-12. \$4.80(ph OTS); \$2.70(mf OTS).

Histamine excretion was found to be of little or no importance insofar as lethality from acute whole-body irradiation in rats is concerned. Endogenous histamine excretion in female rats was found to be 9 to 10 times greater than in males. Data are included on the effects of diet, gonadectomy, compound 48/80, and hormone treatment on the excretion of histamine before and after irradiation. (C.H.)

## RADIATION HAZARDS AND PROTECTION

Refer to abstract 3030.

## RADIOTHERAPY

## 2968 NAA-SR-1458

North American Aviation Inc., Downey, Calif.

ENERGY DEPOSITION IN TISSUE BY NEUTRONS OF VARIOUS ENERGIES AND THE  $\text{B}^{10}(\eta, \alpha)\text{Li}$  REACTION. M. A. Greenfield. 9p. Contract [AT-11-1-GEN-8]. \$1.80(ph OTS); \$1.80(mf OTS).

A comparison is made of the energy deposition in tissue due to Boron Disintegration Therapy with the background dosage in healthy tissue due to direct effects of thermal, intermediate energy, and fast neutrons. Minimum values of  $\text{B}^{10}$  concentration in a lesion are obtained that will lead to a desired ratio of tumor dose to healthy tissue dose. Upper limits are set to the fraction of a neutron beam that may consist of non-thermal neutrons. (auth)

## TOXICOLOGY STUDIES

## 2969 AECU-3140

Trudeau Foundation, Saranac Lake, N. Y.

STUDIES ON THE EXPERIMENTAL PATHOLOGY AND BIOCHEMISTRY OF THE PULMONARY GRANULOMATOSIS OF BERYLLIUM WORKERS. SECTION II. CONSOLIDATED PROGRESS REPORT. G. W. H. Schepers. Apr. 25, 1955. 39p. Supplement: A REVIEW OF THE PHYSICAL CHEMISTRY OF BERYLLIUM. Lester D. Scheel. May 10, 1955. 57p. Contracts AT(30-1)-1733 and AT(30-1)-1398. \$15.30(ph OTS); \$5.40(mf OTS).

The status of research is reviewed in a study of pulmonary granulomatosis in beryllium workers. Equipment for use in dust exposure studies is described. Preliminary results are reported from studies on the tissue distribution and pathological effects of Be dust in rats; the physical chemistry of solutions of Be salts; the effects of Be on enzyme systems; and the effects of ascorbic acid on Be excretion. (C.H.)

## TRACER APPLICATIONS

## 2970 AECU-3101

Michigan State Univ., East Lansing.

THE ABSORPTION AND DISTRIBUTION OF RADIO-STRONTIUM ( $\text{Sr}^{89}$ ) AND RADIORUTHENIUM ( $\text{Ru}^{103}$ ) IN CERTAIN VEGETABLE CROPS (thesis). Charles Glenn Johns. [Sept. 1955]. 33p. Contract [AT(11-1)-159].

The effects of temperature, pH, and time interval between treatment and harvest upon the absorption and distribution of  $\text{Sr}^{89}$  and  $\text{Ru}^{103}$  by beans, tomatoes, corn, and radishes were studied. Results are tabulated and discussed. (C.H.)

## CHEMISTRY

## 2971 AEC-tr-2362

FUEL CELLS FOR DIRECT TRANSFORMATION OF CHEMICAL ENERGY INTO ELECTRICAL ENERGY. O. K. Davtyan. Translated from Preface to Problema Neposredstvennogo Prevrashcheniya Khimicheskoy Energii Topliva v Elektricheskuyu. (The Problem of the Direct Transformation of Chemical Energy of Fuel into Electrical Energy), p3-7. *Izdatel'stvo Akad. Nauk S.S.S.R.*, (LC QD 553 .D3 copy 2.)

## ANALYTICAL PROCEDURES

## 2972 CN-2043

[Clinton Labs., Oak Ridge, Tenn.].

ANALYSIS OF POTASSIUM AND SODIUM SOLUTIONS. Problem Assignment No. CX3-4. DEVELOPMENT OF RADIOCHEMICAL ANALYTICAL PROCEDURES FOR PLUTONIUM. G. L. Johnson, D. E. Koshland, Jr., and



C. W. Smith. June 30, 1945. Decl. Nov. 18, 1955. 9p. Contract W-7405-eng-39.

The "standard lanthanum fluoride procedure" for the analysis of plutonium is accurate in the presence of 2 M sodium ion and of 0.05 M potassium ion. If analysis in the presence of higher concentrations of potassium ion is required, modifications in the procedure are necessary to prevent heavy deposits of solid material on the final platinum plate. Two relatively simple ways of modifying the procedure which led to accurate results have been developed. (auth)

#### 2973 UCLA-337

California. Univ., Los Angeles. Atomic Energy Project. RELATIVE RETENTION OF STRONTIUM AND CALCIUM IN BONE TISSUE. George V. Alexander, Ralph E. Nusbaum, and Norman S. MacDonald. June 14, 1955. 21p. Contract AT-04-1-GEN-12.

Bones of laboratory-raised mice, rats, and guinea pigs, together with their respective diets were analyzed for Sr and Ca by an emission spectrographic technique. Kangaroo rats and rabbits from the Nevada desert areas were also investigated along with representative samples of their forage. The number of atoms of Sr per thousand atoms of Ca present in the bone samples ranged from 0.19 for rats to 2.5 for guinea pigs. This Sr/1000 Ca value was relatively constant for members of a given species, regardless of age. The Sr/1000 Ca atom ratio of the bone tissue was always lower than that of the diet which suggested a quantitative difference in the metabolic treatment of Sr with respect to Ca, favoring retention of the latter. The term "bone retention factor" was introduced to describe the ratio of the concentration of an element with respect to Ca for bone tissue divided by the ratio for the diet. The bone retention factor for Sr in mice was 0.35, in rats 0.27, and in guinea pigs 0.22. The retention factors for the Nevada desert animals were: jack rabbits -0.20, cotton-tail rabbits -0.22, and kangaroo rat -0.16. Some uses for the bone retention factor have been discussed. It has been suggested that a prediction of the skeletal uptake of radiostrontium by humans, through continued consumption of contaminated food, might be made from a knowledge of this retention factor, the Sr:Ca ratio of the diet and the level of radiostrontium contamination. (auth)

#### 2974 UR-426

Rochester, N. Y. Univ. Atomic Energy Project. A NOTE OF PRECISION PLATING OF POLONIUM. Margaret Frisch and Isaac Feldman. Jan. 4, 1956. 9p. Contract W-7401-eng-49. \$1.80(ph OTS); \$1.80(mf OTS).

Previously published reports leave the impression that the analysis for Po by its spontaneous plating on a metal foil is somewhat inaccurate (best report is  $\pm 5\%$ ). The best features of the various published methods were combined to give a procedure which enabled Po recoveries of 99% and better. Possible errors in previous reports are noted. (auth)

Refer also to abstract 2997.

### DEUTERIUM AND DEUTERIUM COMPOUNDS

#### 2975 KLI-1098

Carbide and Carbon Chemicals Co. K-25 Plant, Oak Ridge, Tenn.  
SEPARATION OF  $D_2O/H_2O$  BY HIGH TEMPERATURE

DISTILLATION. G. F. Mills. Sept. 26, 1951. Decl. Oct. 17, 1955. 8p. Contract W-7405-eng-26.

Engineering studies of a distillation plant (operating temperature =  $330^\circ C$ ) for the production of 1%  $D_2O$  are outlined. Plate requirements and tower height were calculated. The separation coefficient,  $\alpha$ , for  $HDO/H_2O$  was estimated to be  $\sim 1.02$ . (C.W.H.)

#### 2976 NBS-C-562

National Bureau of Standards, Washington, D. C. BIBLIOGRAPHY OF RESEARCH ON DEUTERIUM AND TRITIUM COMPOUNDS 1945 TO 1952. Lawrence M. Brown, Abraham S. Friedman, and Charles W. Beckett. Jan. 27, 1956. 85p. \$0.50(GPO)

A bibliography of 2,482 references to published research on the properties of deuterium and tritium compounds is given. The subject matter of each entry in the bibliography is indicated by letter codes related to a list of broad subject headings shown in the introduction. An index of deuterium and tritium compounds and a subject index are included. (auth)

### RADIATION EFFECTS

#### 2977 HW-40142

Hanford Atomic Products Operation, Richland, Wash. THE PROMOTION OF CHEMICAL REACTION BY PILE RADIATION. Final Report on Production Test 105-504-E. R. E. Woodley. Nov. 22, 1955. 52p. Contract W-31-109-Eng-52.

The effect of pile radiation on the chemical systems, graphite plus  $CO_2$ , graphite plus 85%  $CO_2$ -15%  $N_2$ , graphite plus 70%  $CO_2$ -30% He, graphite plus oxygen, graphite plus liquid  $H_2O$ , graphite plus  $H_2O$  vapor carried by  $N_2$ ,  $CO_2$  in the absence of graphite, CO in the absence of graphite, and  $CF_4$  plus Al, has been investigated by exposing these systems to the intense radiation in an in-pile water-cooled facility. The low temperature irradiation of graphite under an atmosphere of  $CO_2$  results in the formation of CO, part of which subsequently decomposes to form CO and a solid polymer of one or more carbon suboxides. A very slow approach to equilibrium is indicated by the constancy of ion pair yields and G values. The dilution of  $CO_2$  with either  $N_2$  or He results in a decreased rate of  $CO_2$  reduction as a consequence of its decreased partial pressure. Both diluents increase the dosage received by the  $CO_2$  however. Ion pair yields and G values show satisfactory agreement with those calculated for the graphite-pure  $CO_2$  system. In the absence of graphite, the radiation-induced reduction of  $CO_2$  rapidly attains an equilibrium state with about 1% of the  $CO_2$  reduced to CO and  $O_2$ . Upon irradiation, graphite reacts with  $O_2$  to form  $CO_2$  at a rate which appears to be about three times as rapid as the reduction of  $CO_2$  by graphite. The formation of  $H_2$  and  $CO_2$  occurs when graphite is irradiated in the presence of liquid  $H_2O$ . The decomposition of  $H_2O$  into  $H_2$  and  $O_2$  proceeds rapidly to a steady state. The extent of reaction between graphite and  $H_2O$  vapor carried by  $N_2$  was limited by the amount of  $H_2O$  vapor present. The reaction results in the formation of  $CO_2$  and  $H_2$ . Carbon monoxide decomposes to  $CO_2$  and a solid polymer of one or more of the carbon suboxides upon exposure to pile radiation. The carbon content of the polymer increases with increasing dosage. Carbon tetrafluoride reacts only slightly with Al upon irradiation but undergoes an extensive reaction with the quartz ampoule. The latter



reaction was essentially complete and resulted in the formation of  $\text{CO}_2$  and  $\text{SiF}_4$ . (auth)

## RARE EARTHS AND RARE-EARTH COMPOUNDS

### 2978 AECD-3727

[National Bureau of Standards, Washington, D. C.]  
THE DETERMINATION OF RARE EARTHS IN URANIUM BASE MATERIALS. [Collected Paper No. 39 Covering Period] September 1942-June 1946. Robert L. Bernard and Clement J. Rodden. Decl. with deletions Sept. 22, 1948. 14p.

A gravimetric method for the determination of total rare earths in uranium base materials of high purity has been developed. The rare earths are precipitated as hydroxides in  $\text{Na}_2\text{O}_2$  solution, while U and certain other elements remain in solution. (C.W.H.)

### 2979 MLM-995

Mound Lab., Miamisburg, Ohio.

A PROCESS FOR THE SEMIMICRO PREPARATION OF ELEMENTAL LANTHANUM BY REDUCTION OF LANTHANUM BROMIDE OR CHLORIDE BY POTASSIUM VAPOR. Wilson H. Power, George L. Fox, and John B. Otto, Jr. July 30, 1954. 38p. Contract AT-33-1-GEN-53. Charge \$6.30(ph OTS); \$3.00(mf OTS).

Elemental La was prepared by reduction of  $\text{LaBr}_3$  and  $\text{LaCl}_3$  by K vapor. The reduction was carried out in vacuo by passing gaseous K over the  $\text{LaX}_3$ . By using a large excess of K vapor and controlling the reaction temperature the KX produced by the reaction was volatilized during reduction without appreciable loss of  $\text{LaX}_3$ . The volatilization of the KX not only separated it from the product, but assisted in driving the reaction to completion. The relatively nonvolatile elemental La remained in the reduction crucible. The La samples prepared by this method were free of K and halogen. Almost quantitative yields were obtained in the K reduction of  $\text{LaBr}_3$ . When potassium was used to reduce  $\text{LaCl}_3$ , only about 90% yields were obtained because of spattering of molten material from the crucible. (auth)

## SEPARATION PROCEDURES

### 2980 ACCO-8

American Cyanamid Co. Atomic Energy Div., Watertown, Mass.

ION-EXCHANGE STUDIES ON CARBONATE LEACH LIQUORS FROM GRANTS, N. M. ORES. Charles S. Abrams, Oct. 30, 1951. Decl. Sept. 23, 1955. 26p. Contract AT(49-1)-533.

Samples from the Grants area were leached with sodium bicarbonate solution and extractions of over 90% were obtained. The leach liquors were passed over a bed of strong base anion exchange resin, Amberlite IRA-400, with almost quantitative adsorption of the uranium; the resin loading at cutoff averaged 19 mg. of  $\text{U}_3\text{O}_8$  per ml. of resin. The barren effluent was recycled. The uranium on the resin was eluted with a +4M  $(\text{NH}_4)_2\text{SO}_4$  solution followed by a 2M  $(\text{NH}_4)_2\text{SO}_4$  + 1M  $\text{H}_2\text{SO}_4$  solution; uranium in the eluate was precipitated with  $\text{NH}_3$ . Over 99% of the uranium in the leach liquor was recovered by the ion exchange process. (auth)

### 2981 ACCO-27

American Cyanamid Co. Atomic Energy Div., Watertown, Mass.

URANIUM RECOVERY FROM A TEMPLE MOUNTAIN DISTRICT ORE SAMPLE. F. W. Bloecher, Jr. Oct. 20, 1952. Decl. Sept. 23, 1955. 33p. Contract AT(49-1)-533.

A sample of Temple Mountain, Utah, uranium ore, containing 0.06%  $\text{U}_3\text{O}_8$ , as carnotite and thucholite, and 0.22%  $\text{V}_2\text{O}_5$ , was found to be quite amenable to treatment by leaching with either cold, dilute sulfuric acid, or hot, dilute sodium carbonate solution. Although uranium extractions of 85 to 90% were readily effected, vanadium extractions ranged from 15 to 30%. Attrition scrubbing of minus 20 mesh ore concentrated over 80% of the uranium into the minus 200 mesh slimes. These slimes were also amenable to either sulfuric acid or sodium carbonate leaching. Ion exchange treatment of either sulfuric acid or carbonate leach liquors appears quite promising. (auth)

### 2982 ACCO-32

American Cyanamid Co. Atomic Energy Div. Raw

Materials Development Lab., Winchester, Mass.  
METALLURGICAL INVESTIGATION OF VARIOUS GRANTS, NEW MEXICO, LIMESTONE ORES. Edmund G. Brown. May 12, 1953. Decl. Sept. 23, 1955. 34p. Contract AT(49-1)-533.

Dry crushing and sizing tests, as well as wet scrubbing tests, were made on the 6-3 and 6-4 ores, but the uranium was so evenly distributed through all the size fractions that no concentration of the uranium by these methods was possible. A leaching procedure for the extraction of the uranium from the 6-5 ore was developed. This consisted in grinding the ore to 85% minus 200 mesh and leaching with hot sodium carbonate-sodium bicarbonate solution containing an oxidant. Ninety-three per cent of the uranium was extracted by this procedure. (auth)

### 2983 ACCO-35

American Cyanamid Co. Atomic Energy Div. Raw Materials Development Lab., Winchester, Mass.

RECOVERY OF URANIUM FROM VITRO LEACH LIQUORS BY ION EXCHANGE. PART I. THE EFFECT OF MOLYBDENUM ON URANIUM ADSORPTION AND SUBSEQUENT CYCLIC COLUMN TESTING OF LEACH LIQUOR. Norman N. Schiff, Ernest T. Hollis, and George W. Lower. Mar. 10, 1954. Decl. Sept. 23, 1955. 28p. Contract AT(49-1)-533. Charge \$0.25(OTS).

It was found that molybdenum is strongly held by strong base anion exchange resins. This results in a decrease in the adsorption rate of uranium and consequently a decrease in uranium loading in a multiple column system. Sodium hydroxide is an efficient regenerate for molybdenum. To determine the feasibility of using the ion exchange process on molybdenum containing liquors, a three column cyclic ion exchange test was run on Vitro leach liquors produced from June through November 1952. The feed to the Vitro plant during that time was an 80-20 mixture of Marysville and Temple Mountain ores. The results indicate that uranium can be economically recovered from these liquors by means of an ion exchange column system. (auth)

### 2984 ACCO-36

American Cyanamid Co. Atomic Energy Div. Raw Materials Development Lab., Winchester, Mass.

PRELIMINARY INVESTIGATION OF CARBONATE LEACHING. Edmund G. Brown. Oct. 15, 1953. Decl.



Sept. 23, 1955. 34p. Contract AT(49-1)-533.

A preliminary investigation of carbonate leaching as applied to a Rand cyanided residue for the extraction of uranium was made. The procedure that gave the best extraction of uranium involved leaching at 95°C for 24 hr with 10%  $\text{Na}_2\text{CO}_3$  solution containing 5%  $\text{NaHCO}_3$  and 35 lb per ton of potassium permanganate. Extraction of 89.9% of the uranium was effected by this procedure, but uranium extractions only slightly lower were obtained also by leaching for 24 hr at 95°C with 10%  $\text{Na}_2\text{CO}_3$  solution containing either 2% or 5%  $\text{NaHCO}_3$  and 12 lb per ton of potassium permanganate. Several other procedures were tried, such as leaching with simple sodium carbonate solutions, and sodium carbonate-sodium bicarbonate solutions, both hot and at ambient temperatures; leaching under pressures up to 90 psig and temperatures up to 152°C; leaching with ammonium carbonate solutions containing potassium permanganate or potassium dichromate oxidant; baking at a high percentage of solids at 180°C for two hr and then leaching with carbonate solutions; blunging at a high percentage of solids for two hr and then leaching with carbonate solutions; removal of sulfides and hydrocarbons by flotation and then leaching the flotation tailings with carbonate solutions, but none produced satisfactory extraction of the uranium. (auth)

#### 2985 ACCO-40

American Cyanamid Co. Atomic Energy Div. Raw Materials Development Lab., Winchester, Mass.  
A PILOT PLANT TEST OF THE ELECTROLYTIC URANIUM RECOVERY PROCESS. Galen W. Clevenger. June 17, 1954. Decl. Sept. 23, 1955. 37p. Contract AT(49-1)-533.

The results of a one thousand lb/day pilot plant test of a process for leaching uranium from ores with sodium carbonate followed by simultaneous precipitation of uranium and regeneration of solutions by electrolytic means are presented. Any further work should be done with commercial size units and some data for the design of such units are given. (auth)

#### 2986 ACCO-53

American Cyanamid Co. Atomic Energy Div., Raw Materials Development Lab., Winchester, Mass.  
THE RECOVERY OF VANADIUM BY ION EXCHANGE. C. S. Abrams and T. F. Izzo. July 10, 1954. Decl. Sept. 23, 1955. 30p. Contract AT(49-1)-533.

Adsorption tests, batch and continuous, were run to determine the possibility of recovering vanadium from slime ore pulps by ion exchange. More than 90% of the dissolved vanadium was adsorbed by ion exchange resin when the solution was properly oxidized and the pulp was passed through suitable resin-in-pulp equipment. (auth)

#### 2987 ACCO-61

American Cyanamid Co. Atomic Energy Div. Raw Materials Development Lab., Winchester, Mass.  
ION EXCHANGE STUDIES. PART I. EQUILIBRIUM CONSTANTS. PART II. NATURE OF URANIUM ADSORPTION ON IRA-400. T. L. O'Connor. July 28, 1954. Decl. Sept. 23, 1955. 27p. Contract AT(49-1)-533.

The relative affinities of chloride and bisulfate as compared to sulfate for IRA-400 have been studied. Both have a slightly higher affinity for the resin than sulfate as indicated by equilibrium constant determinations. Investigation on the nature of uranium adsorbed on IRA-400 has shown that the uranium is present principally as uranyl

tri-sulfate complex. Some disulfate complex is also present and the ratio of the two complexes was found to be dependent upon uranium and sulfate concentrations, and pH. (auth)

#### 2988 AECD-3700

Carnegie Inst. of Tech., Pittsburgh. Metals Research Lab.  
ELECTROCHEMICAL SEPARATIONS IN NON-AQUEOUS SOLUTIONS. Occasional Report No. 3 for the Period June 1, 1953 to June 1, 1954. G. M. Pound, Gerhard Derge, June Fullmer, Earl Roland, and Joan Pacacha. June 1, 1954. Decl. with deletions Oct. 31, 1955. 44p. Contract AT(30-1)-1432. \$0.30(OTS).

The electrolytic decomposition potentials of pure fission product metal chlorides in molten  $\text{LiCl-KCl}$  eutectic were measured directly by the current-voltage method as a function of temperature. Certain improvements in the technique relating to dehydration and oxygen removal permitted measurements for even the most electropositive metals. In most cases, the measured values are in reasonable agreement with the thermodynamically calculated values. This means that, in general, there were no large (>0.2 volt) effects due to over-voltage or non-ideality of solution, and that a firm basis now exists for predicting electrolytic separations from a calculated emf series for molten chlorides. Also, it means that the cell design was quite suitable in that side reactions and back-diffusion of products were eliminated. A new back-emf method was developed for measuring decomposition potentials in these fused salt systems. It gives values in good agreement with the current-voltage method, and has the advantage that it permits ready measurement of the individual decomposition potential of each of several components in a fused salt solution. It is concluded that certain electrolytic separations of fission product metals, based on difference in decomposition potential, are possible, and that enough basic information has now been obtained to try such separations on a laboratory scale. (auth)

#### 2989 ISC-458

Ames Lab., Ames, Iowa.  
A COUNTERCURRENT LIQUID-LIQUID EXTRACTOR. Harley A. Wilhelm and Raymond A. Foos. Sept. 3, 1954. Decl. Sept. 8, 1955. 39p. Contract W-7405-eng-82.

The countercurrent liquid-liquid extractor consists essentially of an assembly of mixer-settlers, feeders, reservoirs, and flow lines that are made of glass or other chemical resistant materials. In operation this multi-stage assembly rotates intermittently in one direction on a horizontal axis causing the immiscible phases to progress to opposite ends of the unit. Details for the construction of the extractor and its principles of operation are given. The applicability of the extractor is illustrated by extractions involving Zr and Hf, and Nb and Ta. A fraction containing high purity Hf and one containing high purity Zr were obtained from a liquid solution containing roughly equal amounts of both. Another extraction produced Zr of high purity from a mixture containing largely Hf. Niobium and Ta were also successfully separated. (auth)

#### 2990 ISC-682

Ames Lab., Ames, Iowa.  
SEPARATION OF HAFNIUM FROM ZIRCONIUM USING TRIBUTYL PHOSPHATE. R. P. Cox and G. H. Beyer. Dec. 23, 1955. 14p. Contract W-7405-eng-82. \$0.15 (OTS).



Zircon sand, treated with caustic, was converted into aqueous  $ZrNO_3$  solution and extracted with TBP. The solvent preferentially dissolved the Zr, leaving Hf, in the aqueous phase. The purified Zr was stripped from the solvent with sulfuric acid solution, and the solvent reused. Nitric acid was recovered from both the extractor raffinate and the stripped product by evaporation to dryness. Zirconium sulfate was then converted to either the oxide or the fluoride, as a preliminary step in metal preparation. (auth)

**2991 RMO-2501**

Rohm and Haas Co., Philadelphia.

RECOVERY OF URANIUM WITH ION EXCHANGE RESINS. Progress Report for April 1, 1951–July 1, 1951. Robert Kunin. Decl. Sept. 23, 1955. 20p. Contract AT(49-1)-535.

A comparison has been made of various quaternary anion exchange resins and it has been concluded that Amberlite IRA-400 and Dowex-1 type anion resins are superior to Amberlite IRA-410 and Dowex-2 resins. Factors such as porosity and particle size when varied so as to improve diffusion rates, improve the breakthrough capacity for U. It is possible to alter the porosity so as to obtain resins that are superior to the conventional Amberlite IRA-400 and Dowex-1 resins. Exploratory runs on an experimental chelating resin, Amberlite XE-102, have demonstrated the usefulness of a resin of this type for the Cu–U ores and for U solutions in which the U is not complexed as the anionic complexes. An electrolytic recovery and purification technique has been investigated which involves the electrolytic transfer of the anionic U complex across an anion exchange membrane. The studies indicate that an electrolytic continuous recovery and purification process for U ores is possible. (J.E.D.)

**2992 RMO-2517**

Rohm and Haas Co. Research Labs., Philadelphia.

SUMMARY REPORT ON ELECTROLYTIC MEMBRANE CELL WORK AT CLIMAX URANIUM COMPANY [FOR] PERIOD JANUARY 5, 1953–FEBRUARY 12, 1953. Charles T. Dickert. Feb. 26, 1953. Decl. Sept. 23, 1955. 24p. Contract AT(49-1)-535.

Laboratory work on electrolytic precipitation of U from leach liquors has continued. Data are presented on current-density investigation, initial pH, phosphate content, high U and V head liquors, cathode plating of U and V, electrode performance, and membrane performance. Detailed data on experimental observations are included in the appendix. (J.E.D.)

**2993 UCLA-353**

California. Univ., Los Angeles. Atomic Energy Project. ISOLATION AND CHARACTERIZATION OF SODIUM HYALURONATE FROM HUMAN UMBILICAL CORDS. Norman S. Simmons. Nov. 14, 1955. 21p. Contract AT-04-1-GEN-12.

A method is described for the isolation of apparently homogeneous sodium hyaluronate from human umbilical cords. Unique use is made of sodium xylene sulfonate to complex and precipitate accompanying proteins at pH 4 in the cold. Sulfated polysaccharides are removed with an amine ion exchange resin in the presence of sodium acetate at pH 7. Hyaluronate is critically precipitated by the addition of 0.8 volume of isopropyl alcohol in the presence of 0.3M sodium acetate at pH 7. Polyvalent cations are complexed with Versene. Sodium acetate is completely

removed by washing with ethyl alcohol. The overall yield is about 1% of the dry weight of the cords. (auth)

**2994 Y-449**

Carbide and Carbon Chemicals Corp. Y-12 Plant, Oak Ridge, Tenn.

SUMMARY OF PROGRESS ON THE SEPARATION OF ZIRCONIUM AND HAFNIUM. W. M. Leaders. July 22, 1949. Decl. Nov. 17, 1955. 10p. Contract W-7405-eng-26.

Investigations on the separation of Hf from Zr by means of the thiocyanate method are discussed. Initial operating data for the countercurrent column are summarized. The benzene–TTA extraction system was also investigated. (C.W.H.)

**2995 Y-477**

Carbide and Carbon Chemicals Corp. Y-12 Plant, Oak Ridge, Tenn.

SEPARATION OF HAFNIUM FROM ZIRCONIUM BY EXTRACTION OF THIOCYANATE COMPLEXES. PART II. CHEMICAL STUDIES. L. G. Overholser, C. J. Barton, and W. R. Grimes. Sept. 9, 1949. Decl. Nov. 17, 1955. 35p. Contract W-7405-eng-26.

The study of preferential extraction of hafnium thiocyanate by organic solvents previously described has been considerably extended. A survey of various available solvents has indicated that hexone is considerably superior to diethyl ether and to the several others tested. Partition of thiocyanic acid between hexone and aqueous phases of various compositions has been investigated. It has been demonstrated that the extracted hafnium and zirconium may be almost quantitatively removed from the hexone phase by contact with sulfuric acid permitting recycle of the hexone phase at the expense of less than 1% of its contained thiocyanic acid. This and other data presented indicate that the method may be simply and economically applied to produce zirconium whose hafnium content compares very favorably with that obtainable by an reported procedure. (auth)

**2996 Y-611**

Carbide and Carbon Chemicals Co. Y-12 Plant, Oak Ridge, Tenn.

PREFERENTIAL EXTRACTION OF ZIRCONIUM AND HAFNIUM THIOCYANATES PREPARATION OF PURE HAFNIUM. C. J. Barton, Sr., L. G. Overholser, and W. R. Grimes. June 6, 1950. Decl. Nov. 17, 1955. 21p. Contract W-7405-eng-26.

Selective stripping of Zr from the hexone–thiocyanate solution has been shown to be feasible in laboratory scale equipment. Sulfate-free wash solutions are not materially improved, insofar as the separation of Hf and Zr is concerned, by addition of thiocyanate. Hydrochloric acid solutions are slightly more efficient than water for the stripping operation. Higher separation factors are obtained with wash solutions containing sulfate ion though such systems will be difficult to justify in practice because of the undesirability of sulfate in the recycled Zr solutions. The distribution of Zr and Hf as thiocyanates between organic and aqueous phases has been shown to be a function of metal concentration, especially in sulfate-free systems; the lower metal concentrations favor extraction by hexone. The dependence of separation factors on metal concentration has been shown to be small. (auth)

Refer also to abstract 2999.



## SYNTHESES

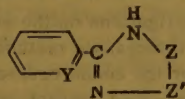
## 2997 NYO-6506

Pittsburgh. Univ.

THE EVALUATION OF SOME RELATED HETEROCYCLIC COMPOUNDS AS ANALYTICAL REAGENTS FOR METALS (thesis). Joseph Lawrence Walter. Sept. 1955. 142p.

Contract AT(30-1)-860.

The syntheses and analytical uses of heterocyclic compounds having a general structure



(where Z-Z' is CH<sub>2</sub>-CH<sub>2</sub> or a phenyl group, and Y is C-OH, C-SH, or N) are described. (C.W.H.)

## TRITIUM AND TRITIUM COMPOUNDS

Refer to abstract 2976.

## URANIUM AND URANIUM COMPOUNDS

## 2998 ACCO-60

American Cyanamid Co. Atomic Energy Div. Raw Materials Development Lab., Winchester, Mass.

THE RELATIONSHIP BETWEEN OXIDATION REDUCTION POTENTIAL AND VALENCE STATE OF IRON, VANADIUM AND URANIUM IN SULFURIC ACID LEACH LIQUORS.

Julia G. Toohey and David Kaufman. July 1954. Decl.

Sept. 23, 1955. 30p. Contract AT(49-1)-533.

Potentiometric titrations on a variety of acid leach liquors containing Fe, U, and V showed good correlation between EMF and oxidation state of the various elements in spite of wide variations in liquor composition. The titration curves showed four distinct breaks when titrations were made under proper conditions. From the curves, concentrations of Fe, U, and V could be determined. The potentiometric method was found to be particularly applicable to the determination of Fe<sup>2+</sup>. Tentative method for U<sup>4</sup> based on direct precipitation with cupferron was found to be unreliable. (auth)

## 2999 BMI-274

Battelle Memorial Inst., Columbus, Ohio.

THE RECOVERY OF URANIUM FROM CHATTANOOGA SHALES. Final Report [for November 15, 1952 to

January 14, 1954]. R. Q. Wilson, R. A. Ewing, J. E.

Hanway, Jr., W. A. Meeley, A. E. Bearse, R. B. Filbert,

Jr., F. M. Stephens, Jr., and J. W. Clegg. Jan. 14, 1954.

Decl. Oct. 17, 1955. 138p. Contract AT(49-1)-641.

A process for extracting uranium from Chattanooga shale was developed. It comprised retorting the shale at a temperature between 1000 and 1100°F, followed by an oxidizing roast at 1000°F, leaching the roasted calcine in 2 to 4% sulfuric acid, separating the leached calcine from the pregnant leach liquor, and recovering the uranium by ion exchange. Tests were made in their gas-combustion retorts at a feed rate of 148 to 209 lb./ft<sup>2</sup>/hr. About 10 gallons of shale oil were recovered per ton of feed under optimum conditions. Roasting investigations were made in fluidized-bed furnaces at feed rates up to 65 lb./ft<sup>2</sup>/hr. Fifty to sixty % of the uranium in the roasted calcine was solubilized in 2 to 4% sulfuric acid. Four solid-liquid separation methods were studied. Sedimentation tests

showed a minimum thickener-area requirement of 14.4 ft<sup>2</sup>/ton/day. Continuous filtration rates of 400 to 600 lb./ft<sup>2</sup>/day were indicated. Exploratory tests showed that centrifugation also could be used but that liquid cyclones were not applicable. Recovery studies indicated that a columnar anion-exchange process using Amberlite IRA-400 resin was feasible but that contaminating ions in the leach solution reduced its efficiency. Preliminary work on a solvent extraction process in the roasted-shale slurry showed some promise; however, an emulsion problem was encountered. (auth)

## 3000 BMI-550

Battelle Memorial Inst., Columbus, Ohio.

THE THERMODYNAMICS OF THE REDUCTION OF URANIUM COMPOUNDS TO URANIUM METAL. A. W. Lemmon, J. J. Ward, S. M. Fischer, C. J. Geankoplis, and J. W.

Clegg. July 21, 1952. Decl. Oct. 6, 1955. 58p. For Catalytic Construction Co. Contract AT(30-1)-1060, Sub-contract No. 459.

The thermodynamic study was undertaken to guide the evaluation of new processes for the conversions of uranium compounds to uranium metal. The objective was to show which processes might well justify experimental effort and which processes can be discarded from further consideration on the ground of thermodynamic impracticability. It was necessary to evaluate critically the available experimental thermodynamic information so that the degree of reliance in the conclusions reached may be established. Also, because of the nonexistence of certain experimental values, estimations were necessary. In all cases, these are so identified. (auth)

## 3001 HW-39767

Hanford Atomic Products Operation, Richland, Wash.

THE PREPARATION OF PRIMARY STANDARD U<sub>3</sub>O<sub>8</sub>. R. J. Brouns and W. W. Mills. Nov. 16, 1955. 13p. Charge \$0.15(OTS).

Standard U<sub>3</sub>O<sub>8</sub> can be prepared by igniting uranyl nitrate or UO<sub>3</sub> to constant weight in air at 1000°C. Under these conditions, the conversion of U to U<sub>3</sub>O<sub>8</sub> is stoichiometric within at least ±0.02% and U<sub>3</sub>O<sub>8</sub> is thermally stable in air up to at least 1200°C. (auth)

## 3002 HW-39969

Hanford Atomic Products Operation, Richland, Wash.

A NON-DESTRUCTIVE METHOD FOR THE DETERMINATION OF URANIUM-235 IN URANIUM METAL SLUGS.

D. G. Miller. Oct. 7, 1955. 26p. Contract W-31-109-Eng-52. Charge \$0.25(OTS).

A nondestructive method for the determination of the U<sup>235</sup> concentration of U slugs using a γ scintillation counter has been developed. The method is based on a determination of the differential counting rate exhibited by the 0.2 Mev photopeak associated with the decay of U<sup>235</sup>. Routine determinations can be readily obtained to a precision of ±0.03 wt.% U<sup>235</sup> (95% confidence level). (auth)

Refer also to abstracts 2978 and 3011.

## WASTE DISPOSAL

## 3003 HW-38218(Rev.)

Hanford Atomic Products Operation, Richland, Wash.

A STUDY OF THE EFFECTIVENESS OF DECONTAMINATING AGENTS ON CONTAMINATED PROTECTIVE



**CLOTHING.** J. L. Norwood. July 29, 1955. 19p. Contract W-31-109-Eng-52. \$0.20(OTS).

A series of one hundred and thirty-nine tests were conducted using twenty-two decontaminating agents either in combination. The tests clearly indicated that complexing agents are most effective in removing metallic ions strongly fixed to cotton cloth. It was also demonstrated that large quantities of water in the washer wheel provide greater possibilities for floating away loose radioactive particles and also show better results in removing complexed or inactivated metallic ions from cotton fabric. Soaps, clays, silicates and other recognized commercial laundry materials have little value in removing normal radioactive contaminants from plant clothing. The compounded agents containing glassy phosphate salts, carbonate and ammonium ions proved to be most effective throughout the tests. Specifically, Turco 4182-A which combined the most desirable characteristics has been adopted in the Process Laundry as the basic decontaminating agent. (auth)

## ENGINEERING

### HEAT TRANSFER AND FLUID FLOW

#### 3004 APEX-238

General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati.

REPORT OF ANALYSIS OF PRESSURE DROP DATA FOR A MULTIPLE TUBE CONFIGURATION. R. C. Brubaker. Apr. 8, 1955. 10p. (DC-55-4-46) \$3.30(ph OTS); \$2.40 (mf OTS)

Results of the analysis of data from a flow test of a tube bundle are presented. The equation  $f = 0.0155 N_{re}^{-0.1}$  conservatively represents the friction factor relationship for that part of the data which appears consistent. (auth)

## MINERALOGY, METALLURGY, AND CERAMICS

### CORROSION

#### 3005 BMI-1046

Battelle Memorial Inst., Columbus, Ohio.

CORROSION OF SELECTED MATERIALS IN PENTALENE 290 AND A MIXTURE OF DOWTHERM A AND ALKYL-BENZENE. Walter K. Boyd and Robert S. Peoples. Oct. 14, 1955. 11p. Contract W-7405-eng-92.

Stainless steel, Ni-Cr, Fe-Cr, Zr-Sn, and Al-Fe alloys and Be were equally resistant to Pentalene 290 at 525°F under a  $H_2$  pressure of 35 psi. Aluminum was unaffected by exposure in a 50 wt.% Dowtherm A and alkylbenzene mixture. Pentalene 290 decomposed rapidly at temperatures of 600°F and above. (C.W.H.)

#### 3006 BMI-1047

Battelle Memorial Inst., Columbus, Ohio.

CORROSION IN BORATED AND DEIONIZED WATER AT TEMPERATURES UP TO 500°F. Walter K. Boyd and Robert S. Peoples. Oct. 14, 1955. 20p. Contract W-7405-eng-92.

The effects of applied stress, contact, and crevices on the corrosion of stainless steels, Be, and Al alloys in distilled and borated waters at temperatures up to 500°F were studied. Also, the corrosion resistance of Be when an external heat flux was applied, was determined in boiling distilled  $H_2O$ . (C.W.H.)

### GEOLOGY AND MINERALOGY

#### 3007 TEM-874-A

Geological Survey.

URANIUM OCCURRENCES AT THE MOONLIGHT MINE AND GRANITE POINT CLAIMS, HUMBOLDT COUNTY, NEVADA. A. O. Taylor and J. F. Powers. June 1955. 15p.

The Moonlight mine and Granite Point claims are on the western flank of the Double H Mountains between the Kings River and Quinn River valleys in northern Humboldt Co., Nev. Uranium minerals at the Moonlight mine occur in a vein in intensely altered Tertiary volcanic rocks. The known uranium mineralization is spotty and erratic, but ore-grade material is present in the vein. Samples of the vein taken along its outcrop and in the mine shaft contain from less than 0.02% to 0.40%  $U_3O_8$ . The uranium minerals change from autinite at the surface to torbernite, "gummite(?)" and pitchblende below the 90-ft level of the shaft. The Granite Point claims are two miles north of the Moonlight mine at the base of a rhyolite cliff. Radioactivity traverses made along the base and slope of the rhyolite cliff indicate that a large part of the rhyolite is abnormally radioactive. Radioactivity ranges from 0.013 to 0.3 mr/hr and averaged 0.10 mr/hr in the vicinity of the claims. A sample taken at the base of the rhyolite cliff, at the point of highest radioactivity contains 0.02%  $U_3O_8$ . (auth)

### METALS AND METALLURGY

#### 3008 AECD-3693

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.

THE CONSOLIDATION OF ZIRCONIUM AT SUB-FUSION TEMPERATURES. H. R. Hoge and B. Lustman. Apr. 17, 1950. Decl. with deletions Oct. 12, 1955. 37p. Contract AT-11-1-GEN-14.

The procedures involved in compacting zirconium in graphite molds at elevated temperatures in an inert atmosphere are described. Crystal bar zirconium may be thus consolidated without adversely affecting either hardness or corrosion resistance. Experiments on consolidation of sponge zirconium by this method are described as well as extrusion through graphite dies. (auth)

#### 3009 BMI-728

Battelle Memorial Inst., Columbus, Ohio.

THE CLADDING OF BERYLLIUM. H. A. Saller, J. R. Keeler, and E. R. Szumachowski. Feb. 26, 1952. Decl. Nov. 9, 1955. 20p. Contract W-7405-eng-92.

Beryllium was roll clad with Ni, Monel, Inconel, Ti, Zr, and Armco iron. All of these metals formed hard, brittle diffusion products at the Be interface, and the resulting bonds were weak. Efforts to find an intermediate "barrier" metal for use between the Be and the desired cladding metals were unsuccessful. Diffusion tests of Be with Cu, Ag, Mo, W, Ta, Nb, Mn, Cr, Co, Pt, and Pd indicated that



all of these metals also formed hard, brittle diffusion products with Be. Al did not form brittle diffusion products with Be, but efforts to roll-clad Be with Al were unsuccessful. (auth)

### 3010 BMI-832

Battelle Memorial Inst., Columbus, Ohio.

CREEP OF ZIRCONIUM-TIN ALLOYS. W. Chubb and A. D. Schwöpe. May 27, 1953. Decl. Nov. 22, 1955. 18p. Contract W-7405-eng-92.

The effect of tin upon the creep resistance of zirconium at 260°C was investigated. Alloys containing 0 to 5 wt.% tin were prepared by induction melting using sponge zirconium. The results have been used to estimate the stress required to cause 1% total deformation in 1000 hr for each composition. Comparison with short-time tensile data for the same alloys indicates that there is a relation between the creep resistance of these alloys and their short-time tensile yield strengths at 260°C. (auth)

### 3011 ISC-656

Ames Lab., Ames, Iowa.

URANIUM-ZINC SYSTEM. P. Chiotti, H. H. Klepfer, and K. J. Gill. Oct. 21, 1955. 26p. Contract W-7405-eng-82. \$4.80(ph OTS); \$2.70(mf OTS)

A study was made of the phase fields existing in the U-Zn system at one atm. pressure and at five atm. pressure as determined from x-ray, metallographic, thermal, and vapor pressure data. Only one compound,  $UZn_3$ , is formed in this system. Properties of this compound are described. A phase diagram is presented for the U-Zn system and data are included on the solubility of U in Zn at various temperatures. (C.H.)

### 3012 NYO-7080

Massachusetts Inst. of Tech., Cambridge. Dept. of Metallurgy.

X-RAY AND CALORIMETRIC INVESTIGATIONS OF COLD WORKING AND ANNEALING OF A GOLD-SILVER ALLOY. Technical Report No. 22. B. L. Averbach, M. B. Bever, M. F. Comerford, and J. S. L. Leach. Nov. 22, 1955. 26p. Contract AT(30-1)-1002, Scope III.

Calorimetric and x-ray-diffraction line broadening measurements were carried out on samples of a 75 wt.% Au-25 wt.% Ag alloy deformed by filing and annealed at various temperatures up to 500°C. Stored energy, hardness, subgrain size, local strain, and short range order determinations were made. It appears that most of the stored energy is associated with the presence of sub-boundaries; a small fraction of the energy is attributable to a reduction in the short range order and a negligible amount is stored in the local elastic distortions. The recovery process involves a substantial reduction of the local strains and a small increase in the subgrain size in this alloy. Recrystallization appears to involve a removal of the low angle boundaries and the complete elimination of the local strains. (auth)

### 3013 SEP-149

Bridgeport Brass Co., Conn.

FABRICATION OF ZIRCONIUM SHELLS. Part 2. A Technical Progress Report and Tentative Development Specifications [for] November 1952-June 1953. R. S. French, C. H. Mayer, and R. S. Pratt. Mar. 15, 1954. Decl. Oct. 18, 1955. 38p. Contract AT-30-1-GEN-366, Subcontract S-AEC-1.

Metallurgical and mechanical property tests were completed on two lots of alloy of the Zircalloy I type and

an additional lot of arc melted sponge. Cold forming studies completed on the alloy indicated these particular lots unsatisfactory for deep drawing. Bending as required in cupping and repeated folding was always accompanied by fine surface cracks in the radii produced that led to immediate or eventual failure. Further study on more selected stock will be required to differentiate the cause of the action between surface embrittlement effects or a more basic alloy property. Annealing and cleaning procedures were given further study and salt was found to be the most effective for fabrication anneals. While other methods were also tried, no influence from annealing procedure predominated in hot water corrosion studies of cleaned zirconium shells. Tools were developed for a larger size shell than has previously been attained and following preliminary laboratory work, the tools were adopted to factory press equipment for a pilot development study. With certain precautions in regard to press speed, folding and stripping tools, arc melted sponge zirconium may be fabricated in standard commercial equipment and tentative development specifications are presented in the appendix. (auth)

### 3014 TID-5184

Illinois Inst. of Tech., Chicago. Armour Research Foundation.

INVESTIGATION OF THE SOUNDNESS OF WROUGHT ZIRCONIUM. Final Report [for] January 5, 1953-August 28, 1953. Verne Pulsifer. [APPENDIX A]. BIBLIOGRAPHY ON NON-DESTRUCTIVE TESTING FOR INVESTIGATION OF SOUNDNESS OF WROUGHT ZIRCONIUM. R. W. Hanzel. [APPENDIX B]. LITERATURE SURVEY ON NON-DESTRUCTIVE TESTING OF NON-MAGNETIC MATERIALS. Conducted by John Crerar Library. [APPENDIX C]. BONDING OF ZIRCONIUM BY HOT ROLLING. Robert Denison. [APPENDIX D]. METALLOGRAPHIC EXAMINATION OF ZIRCALOY TUBING. R. W. Hanzel. Oct. 26, 1953. Decl. October 7, 1955. 113p. Project No. B 050-3. Contract [AT-11-1-GEN-14], Subcontract 14-309, Task 4.

### 3015 WAPD-T-20

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.

EFFECT OF HYDROGEN ON THE EMBRITTLEMENT OF ZIRCONIUM AND ZIRCONIUM-TIN ALLOYS. W. L. Mudge, Jr. Nov. 15, 1952. 38p. Contract AT-11-1-gen-14. \$6.30(ph OTS); \$3.00(mf OTS).

Zirconium and zirconium-tin alloys, as presently processed, have been found to be susceptible to embrittlement in the notch impact test when subjected to certain heat-treatment conditions. Embrittlement results from a preage at a temperature above 600°F followed by either a slow cool or a quench directly to an isothermal heat treatment in the temperature range 200 to 435°F (95 to 225°C). Susceptibility to embrittlement is found to be independent of: type of base material used (whether deBoer process crystal bar or Kroll process sponge), tin content, and melting procedure. Hydrogen is considered to be responsible for the embrittlement and may cause noticeable reductions in impact strength when present in amounts of 10 ppm or greater. (auth)

### 3016 Y-824

Carbide and Carbon Chemicals Co. Y-12 Plant, Oak Ridge, Tenn.

SUPPLEMENTARY INFORMATION ON PRODUCTION OF



ZR AT Y-12. J. W. Ramsey and W. K. Whitson, Jr. Nov. 15, 1951. Decl. Nov. 18, 1955. 31p. Contract W-7405-eng-26.

This report includes information on usage and unit cost of chemicals, purity specifications, typical purity values of Y-12 feed and product materials, operating personnel assignments, power requirements, construction costs, pump list and plant operating procedures. (auth)

**3017** AEC-tr-2373

RESEARCH ACTIVITY IN THE FIELD OF METALLURGICAL SINTERING PROCESSES FOR MATERIALS PROCESSING AT THE DRESDEN INSTITUTE OF TECHNOLOGY. Berlin. July 29, 1954. 4p.

The influence of sintering temperature on the various properties of the sintered material was investigated. It is shown that iron powders reach a zone of transition between 850 and 900°C in which the specific properties undergo considerable changes. A finely divided powder increases its density in the process of sintering more than a coarse powder. (tr-auth)

Refer also to abstracts 3005, 3006, and 3050.

## PHYSICS

**3018** CF-52-6-67

Oak Ridge National Lab., Tenn.  
DRYING OF AIR IN ACTIVATED ALUMINA BEDS. Final Report. J. W. Foster. June 9, 1952. Decl. Dec. 7, 1954. 10p. Contract [W-7405-eng-26].

**3019** AEC-tr-2372

THE EFFECT OF VOLUME CHARGES DURING THE DIFFUSION OF INTENSE BEAMS OF CHARGED PARTICLES. M. D. Gabovich. Translated from *Uspekhi Fiz. Nauk* 56, 215-56(1955). 63p.

Results of published reports dealing with the influence of the volume charge on the diffusion of intense beams of charged particles are reviewed and collected for the purpose of indicating phases which require additional experimentation and stricter theory. The diffusion of beams under the effect of their own volume charge, means of intense beam formation, restriction of currents in beams, and volume charge neutralization by oppositely charged particles are considered. Mathematical equations for particle motion, beam structure and focusing, and diffusion behavior are given. (D.E.B.)

## CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

**3020** ANL-5501

Argonne National Lab., Lemont, Ill.  
NEUTRON DIFFRACTION STUDIES OF HAFNIUM-HYDROGEN AND TITANIUM-HYDROGEN SYSTEMS. S. S. Sidhu, LeRoy Heaton, and D. D. Zaubers. Jan. 1956. 27p. Contract W-31-109-eng-38. \$4.80(ph OTS); \$2.70(mf OTS).

Results of neutron and x-ray diffraction studies on Hf-H and Ti-H systems are reported. The first single phase hydride formed is a nonstoichiometric compound with a  $\text{CaF}_2$ -type structure. It deforms to a face-centered

tetragonal structure as the composition approaches  $\text{MX}_2$ . From the crystal structure data of these hydrides the positions of H atoms, the nearest neighbor atoms and their interatomic distances are determined. It is indicated that the size of the "hole" for the H atom in the hydride is such that it must enter as an ion. The effect of metal-H bonds on the physical properties of hydrides, such as characteristic temperature and vibration frequency, is given. Evidence and explanation for the embrittlement of metals by H are offered. (auth)

## INSTRUMENTS

**3021** AECU-3112

DuMont (Allen B.) Labs., Inc. Tube Research Labs., Passaic, N. J.

DEVELOPMENT OF DUMONT PHOTOMULTIPLIER TUBES. Report No. 18 [covering] period June 1, 1955 to August 31, 1955. Bernard R. Linden, Philip A. Snell, and Robert E. Rutherford. 11p. Contract AT(30-1)-1336.

Methods of reducing dark current in large phototubes are being investigated. Low gain characteristics of previous tubes are attributed to a  $\text{H}_2\text{O}$  condensate on the multiplier surface. Improved sealing methods are expected to prevent this condensation. Multiplier phototubes with output currents of one amp. are being investigated. Be-Al secondary emission surfaces have a low emission to voltage ratio which may be of value in overcoming space charge effects. Multiplier transit time spread studies were continued. (D.E.B.)

**3022** ISC-676

Ames Lab., Ames, Iowa.

THE USE OF THERMISTORS IN CRYOSCOPIC MEASUREMENTS. R. K. McMullen and J. D. Corbett. Dec. 14, 1955. 16p. Contract W-7405-eng-82. \$3.30(ph OTS); \$2.40(mf OTS).

The applicability of thermistors to cryoscopic measurements has been examined. A simple Wheatstone bridge was used to measure the temperature-sensitive resistance of the thermistor. Theoretical equations directly relating thermistor resistance at the freezing point to the concentration of the solution have been developed. Data obtained in benzene or 1,4-dioxane with concentrations of phenanthrene or naphthalene up to a mole fraction of 0.008 fit the equations presented with a standard deviation corresponding to about one millidegree. Measurements in pyridine at  $-42^\circ$ , where a Beckmann thermometer cannot be used, gave comparable results. Values calculated for the heats of fusion of the solvents employed agreed quite well with those reported in the literature. Simplified resistance-concentration equations that gave essentially the same results have also been suggested. Results obtained simultaneously with a thermistor and a Beckmann thermometer indicated that the method gave results with about one-third the uncertainty of the usual Beckmann technique. Observations on the stability of thermistors are presented. (auth)

**3023** ORNL-1997

Oak Ridge National Lab., Tenn.  
INSTRUMENTATION AND CONTROLS DIVISION SEMI-ANNUAL PROGRESS REPORT FOR PERIOD ENDING JULY 31, 1955. Feb. 1, 1956. 21p. \$4.80(ph OTS); \$2.70(mf OTS).

The response of scintillation and Cherenkov counters to



gamma radiation from a swimming pool reactor was investigated. Integral bias curves for NaI(Tl) and plastic scintillators and lucite and  $H_2O$  Cherenkov radiators are plotted. Curves of count rate as a function of reactor power are also given. A single-channel differential pulse-height selector circuit was modified for operation with a double-line linear amplifier. The circuit diagram is given. A resistance bridge for measuring the conductivity of fused salts in the range of 0.01 to 10 ohms was developed; a drawing, circuit diagram, and the operating equation are given. Characteristics of a 120-channel analyzer with improved resolution, linearity, stability and capacity are discussed. Progress in high-voltage research, Oracle modification, and rocking-bomb instrumentation is reported. (For preceding period see ORNL-1865.) (D.E.B.)

Refer also to abstract 3044.

## ISOTOPES

### 3024 ANL-WMM-1140

Argonne National Lab., Lemont, Ill.

THE COMPOSITION OF PLUTONIUM, AMERICIUM, AND CURIUM RESULTING FROM IRRADIATION OF  $Am^{241}$  IN A HIGH NEUTRON FLUX. Paul Fields and Molly Ann Weiss. Feb. 20, 1953. Decl. Nov. 22, 1955. 10p. Contract [W-31-109-Eng-38].

The isotopic composition of americium and the conversion of  $Am^{241}$  to  $Cm^{242}$  as a function of time of irradiation in a high neutron flux has been calculated using the known cross sections. The major components of the plutonium and curium fractions from the  $Am^{241}$  irradiation were also calculated where sufficient data on cross sections were available. (auth)

## ISOTOPE SEPARATION

### 3025 ORNL-1144

Oak Ridge National Lab., Tenn.

PRODUCTION SEPARATIONS OF FISSION-PRODUCT GROUPS FOR THE RADIOISOTOPE PROGRAM. P. O. Schallert. July 28, 1952. Decl. July 27, 1955. 19p. Contract W-7405-eng-26.

A general description is given of five years experience in routine production of fission products of high concentration and high activity levels for the radioisotope program. Details of construction and production processes are given for two systems which were built on ion-exchange principles. (auth)

### 3026 ORNL-2028

Oak Ridge National Lab., Tenn.

STABLE ISOTOPES RESEARCH AND PRODUCTION DIVISION SEMI-ANNUAL PROGRESS REPORT FOR PERIOD ENDING NOVEMBER 20, 1955. Feb. 7, 1956. 69p. Contract W-7405-eng-26. \$10.80(ph); \$3.90(mf).

Data are reported from the following studies: measurements of the nuclear magnetic resonance of enriched  $Ba^{135}$  and  $Ba^{137}$ ; anharmonicity corrections to infrared data on  $T_2O$ , THO, and TDO which verified Libby's theoretical calculations; Zeeman studies on Te; anomalous magnetic moment corrections to Landé g factors for electrons; a spectrochemical method using Y as a tracer for the analysis

of certain rare earths in the  $Y_2O_3$  matrix; an analytical analysis of the accuracy of results from the spectrographic assay of U isotopes; x-ray-diffraction data on  $UO_3 \cdot 2H_2O$ ; the mass spectrographic analysis of Cu and Ag halides; development of a method for determining the heat of polymerization; the mass spectrographic analysis of propane; measurement of the U content of the Missouri and Mississippi Rivers using the isotope-dilution technique; methods for the preparation of gaseous samples for the isotopic analysis of carbon silicon, S, B, O, and tritium; modifications in auxiliaries for mass spectrometers; the calutron separation of isotopes of Te, Mo, Sr, Br, S, Sm, Ba, Ti, Li, and Eu; the chemical refinement of isotopes of N, Ni, Te, Rb, rare earths, and Y; and the preparation of target materials and related work. Data are tabulated on isotope shipments and requests pending during the period. Data on the shipment of enriched stable isotopes from 1946 through Nov. 1955 are presented graphically. (For preceding period see ORNL-1908.) (C.H.)

## MASS SPECTROGRAPHY

### 3027 Y-1114

Union Carbide Nuclear Co. Y-12 Plant, Oak Ridge, Tenn. A PNEUMATICALLY OPERATED VACUUM LOCK FOR MASS SPECTROMETERS WITH GLASS ENVELOPES. Harry S. Corey, III. Oct. 12, 1955. 10p. Contract W-7405-eng-26. Charge \$0.25(OTS).

A pneumatically operated vacuum lock for use on the glass envelope of a 60° sector type mass spectrometer is described. Its application is for the routine isotopic determination of elements which can best be determined by solid analysis. (auth)

## MATHEMATICS

### 3028 ANL-5517

Argonne National Lab., Lemont, Ill.

THE "SMOOTH APPROXIMATION" TO HILL EQUATION L. C. Teng. Jan. 1956. 11p. Contract W-31-109-eng-38. \$3.30(ph OTS); \$2.40(mf OTS).

The Symon approximate solution to the Hill equation is analyzed, reinterpreted, and extended. (D.E.B.)

### 3029 WASH-291(Pt-1)

Division of Source and Special Nuclear Materials

Accountability, AEC.

PAPERS PRESENTED AT THE STATISTICAL SECTION ANNUAL MEETING OF ACCOUNTABILITY REPRESENTATIVES, JUNE 20 AND 21, 1955. Pt. 1. Miller N. Hudson. 164p. \$1.00(OTS).

Thirteen papers were presented on statistical problems encountered in SS Materials Accountability programs. Techniques of sampling, measurement, and experimentation are discussed. (C.W.H.)

## MEASURING INSTRUMENTS AND TECHNIQUES

### 3030 AECD-3661

DuPont de Nemours (E. I.) and Co. TNX Div., Wilmington, Del.

THE COMPUTATION OF RADIATION HAZARDS. C. W. J.



Wende. Jan. 11, 1944. Decl. with deletions Aug. 11, 1953. 61p. \$0.40(OTS).

Formulas are presented for use in calculations of radiation dosage due to  $\gamma$  radiation,  $\beta$  particles, and neutrons having energies up to 3 or 4 Mev. The radioactive sources of interest include the nuclear reactor, pile metal and the solutions and slurries prepared therefrom, and those substances which may become activated by neutron bombardment in the pile. Topics discussed include the estimation of radiation intensity; the emission of radiation; the absorption of radiation; and geometrical considerations for use in the calculation of radiation dosages. Both generalizations and rules-of-thumb for use in rough estimates, and detailed formulas for the calculation of more precise dosages, are given. A few sample calculations are included for purposes of illustration. (C.H.)

### 3031 UCRL-3210

California. Univ., Berkeley. Radiation Lab.  
A SCINTILLATION COUNTER FOR PAPER CHROMATOGRAMS. K. Steenberg and Andrew A. Benson. Dec. 5, 1955. 5p. Contract W-7405-eng-48. \$0.15(OTS)

A large-diameter scintillation counter suitable for measurement of the soft beta emitters  $C^{14}$ ,  $S^{35}$ , and  $Ca^{45}$  has been developed. The counter offers a solution to problems of geometry errors in counting the irregular radioactive areas of paper chromatographs. (auth)

## MESONS

### 3032 NEVIS-16

Columbia Univ., Irvington-On-Hudson, N. Y. Nevis Cyclotron Labs.

A DIFFUSION CHAMBER STUDY OF VERY SLOW MESONS. IV. ABSORPTION OF PIONS IN LIGHT NUCLEI. P. Ammiraju. Jan. 1956. 60p. Sponsored by ONR and AEC under Contract N6-ori-110-Task No. 1. (CU-97-56-ONR-1-Phys.; R-116). \$9.30(ph OTS); \$3.60(mf OTS).

The absorption of slow negative pions has been studied in the light nuclei He, C, and N. The dominant reaction in each case has been observed to be:  $\pi^- + He^4 \rightarrow p + 3n$ ;  $\pi^- + C^{12} \rightarrow 2\alpha + 1p + 3n$ ;  $\pi^- + N^{14} \rightarrow 3\alpha + 2n$ . Prong distributions, proton and alpha spectra have been compiled and compared with the theory of Clark and Ruddelsden. The frequency of  $\alpha$ -emission gives strong qualitative support to the  $\alpha$ -particle model of nuclear structure. This is supported by the similarity of the proton spectra. The low average energy of protons and  $\alpha$ -particles support the two nucleon recoil model in the primary absorption act. In this case  $^3S_1$  initial nucleon states (np) are favored over  $^1S_0$  states (pp) in agreement with the inverse reaction—production of mesons in nucleon-nucleon collisions. (auth)

## NUCLEAR PHYSICS

### 3033 BNL-25

Brookhaven National Lab., Upton, N. Y.  
ON THE VARIATION OF  $\eta$  WITH ENERGY IN THE 100-1000 EV REGION. E. P. Wigner. Nov. 1, 1949. Decl. Nov. 30, 1955. 9p.

Fluctuations in the fission yield in the 100- to 1000-ev region led to an investigation of the influencing variables. Changes in fission width from level to level and higher angular momentum phenomena are seen as possible explanations. (D.E.B.)

### 3034 NYO-6457

Bartol Research Foundation, [Philadelphia].  
PROGRESS REPORT OF THE WORK OF THE BARTOL RESEARCH FOUNDATION OF THE FRANKLIN INSTITUTE FOR THE PERIOD SEPTEMBER 2, 1954-SEPTEMBER 30, 1955. Oct. 1, 1955. 34p. Contract AT(30-1)-1679. \$6.30(ph OTS); \$3.00(mf OTS).

The ONR-Bartol Van de Graaff generator was employed in the production of  $Y^{93m}$  by inelastic neutron scattering. Procedures are described which were used in the calibration of counting equipment. A cross section for the production of the 913-kev metastable level of  $Y^{93}$  as a function of the mean neutron energy is presented graphically. A review of results led to the conclusion that caution should be exercised in the use of excitation curves of metastable states for the determination of unknown spins. Progress is reported in studies on the angular distribution of 3.7-Mev neutrons elastically scattered from Zn and 14-Mev neutrons inelastically scattered from  $Fe^{56}$ . Discrepancies in counting geometry were investigated, neutron sources were improved, and modifications made in counting techniques. Data are included from measurements of the  $\gamma$ -ray spectra resulting from the inelastic scattering of neutrons of energy 3.7 Mev by Al, Sb, As, Fe, Se, Si, and S. (For preceding period see NYO-6456.) (C.H.)

### 3035 ORNL-1945

Oak Ridge National Lab., Tenn.  
SOLID STATE DIVISION SEMIANNUAL PROGRESS REPORT FOR PERIOD ENDING AUGUST 30, 1955. Jan. 30, 1956. 89p. Contract W-7405-eng-26. \$13.80(ph OTS); \$4.80(mf OTS)

The effects of fast neutron irradiation on the conductivity and resistivity of GaSb are reported. Data are also given on the insulation resistance and photovoltages of reactor-irradiated electrical insulation. Breakdown dosages of several insulators are tabulated. The magnetic susceptibility of single-crystal InSb was measured from 70 to 650°K. Data pertaining to the thermal neutron irradiation of these crystals are tabulated. Results of a study of the magnetic behavior of a variety of germanium specimens are summarized. The magnetic susceptibility of charge carriers in germanium was studied in order to gain further information on the electronic structure of the conduction band. The paramagnetic centers introduced at different temperatures in MTR-irradiated quartz are listed. The relative paramagnetic susceptibility of  $TiD_2$  is given as a function of reciprocal temperature. The optical spectra of irradiated silica are discussed. The radiation stability of ceramics irradiated in the MTR is summarized. Data on the hardness and tensile properties of irradiated and unirradiated austenitic stainless steels are summarized. Mechanical properties of irradiated carbon steels are also reported. Experiments were conducted to determine how effectively neutron absorbers can reduce the thermal flux in one of the MTR beam holes. Experiments were also conducted on the correlation of MTR neutron flux spectra with radiation damage. Measurements of the fast flux in the BNL graphite reactor were made, and the resultant flux distributions are shown. Resistivity changes in brass and in brass single crystals are reported as a function of neutron irradiation. The effect of neutrons on the precipitation-hardening reaction in Be-Ni alloys was studied. The electron spin resonance was observed in six specimens of irradiated Corning silica



glass. Lattice parameter changes are given for Cd-covered LiF crystals after irradiation and successive anneals. The quenching-in of lattice defects and the density changes on quench of Au-Cd were studied. Diffractometer patterns are shown for irradiated and unirradiated zircon and irradiated glasses. (For preceding period see ORNL-1852.) (B.J.H.)

## NUCLEAR PROPERTIES

### 3036 UCRL-Trans-257

THE ENERGY DEPENDENCE OF COMPLETE NUCLEAR CROSS SECTIONS IN THE RANGE OF NEUTRON ENERGIES FROM 380 TO 630 MEV. V. P. Dzhelepov, V. I. Satarov, and B. M. Golovin. Translated from *Doklady Akad. Nauk S.S.S.R.* 104, 717-20(1955). 13p.

An abstract of this paper appears in *Nuclear Science Abstracts* as NSA 10-1539.

## NUCLEAR REACTORS

### 3037 BNL-152

Brookhaven National Lab., Upton, N. Y.

THE BROOKHAVEN NUCLEAR REACTOR: THEORY AND NUCLEAR DESIGN CALCULATIONS. I. Kaplan and J. Chernick. Jan. 1952. Decl. Nov. 16, 1955. 80p. Contract AT-30-2-Gen-16.

The theory of normal uranium, graphite-moderated, air-cooled piles is reviewed critically and applied to the design of the Brookhaven nuclear reactor. Calculations of the multiplication factor, critical buckling, critical size, effect of the central gap, excess reactivity, temperature coefficients, xenon poisoning, and control rod effectiveness are discussed in detail. Some other design problems are discussed more briefly. The report is to serve later as a basis for a critical comparison of the theory with the actual behavior of the reactor. (auth)

### 3038 BNL-1627

Brookhaven National Lab., Upton, N. Y.

BUCKLING OF LIGHT WATER LATTICES (.600" DIAMETER RODS, 1.3% AND 1.15% 25). Herbert J. Kouts, Kenneth W. Downes, Glen A. Price, Rudolph Sher, and Valentine J. Walsh. Nov. 5, 1953. Decl. Oct. 27, 1955. 18p. Contract AT-30-2-Gen-16.

Three methods are described for measuring the buckling of light-water lattices. In method 1, a sub-critical, cylindrical reactor lattice is placed in the neutron field of the Brookhaven Reactor thermal column. The vertical relaxation length (L) of the neutron-excited thermal neutron flux is then measured as a function of the loaded radius (R), and best values of  $B^2$  and  $\lambda$  (reflector savings) are found which fit the calculated functional dependence of L and R to the measured data. In the second procedure, that of the standard exponential experiment,  $B^2$  and  $\lambda$  are determined from plots of the measured radial and axial variation of the thermal neutron flux, determined by foil exposure. Method 3 is essentially that of the critical assembly. U is loaded in the presence of a Po-Be source until a  $k_{eff}$  of 0.99 is attained. The source is then removed, and the lattice is partly unloaded by steps. Foil counting methods and experimental procedures for obtaining relaxation lengths and radial traverses are explained. Tabulated buckling measurements are given for 1.15 and 1.3% en-

richment factor at 4:1, 3:1, 2:1, 1.5:1 volume ratios. Graphs for  $B^2$  and  $\lambda$  vs. volume ratio and spontaneous fission fluxes vs.  $R_{eff}^{-2}$  are also included. (K.S.)

### 3039 BNL-1779

Brookhaven National Lab., Upton, N. Y.

THE TEMPERATURE COEFFICIENTS OF THERMAL UTILIZATION AND  $\eta$ . R. S. Margulies. Sept. 21, 1953. Decl. Nov. 9, 1955. 17p. Contract AT-30-2-Gen-16.

The temperature coefficient of thermal utilization has been calculated for the BNL reactor, neglecting the effect of leveling in the graphite. Effects considered include hardening in the rod and departure of cross sections from  $1/v$ , in particular the effect of the 0.28-ev resonance in  $U^{235}$ . A similar study of  $(1/\eta)(d/dt)$  is carried out. (auth)

### 3040 IDO-16248

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

A CRITICAL ASSEMBLY HAVING MAXIMUM SENSITIVITY. J. W. Webster. Aug. 31, 1953. Decl. Aug. 25, 1955. 8p. Contract AT(10-1)-205. (MTRL-202)

A design for a Reactivity Measurement Facility which has an internal water filled "thermal column" is considered. It is calculated that when the hole is about the size of one MTR fuel assembly the effect on the reactivity of insertion of fuel or poison is maximized. The sensitivity to fuel is computed to be seven times as much as in the same facility constructed with no internal water region and the sensitivity to poison is 30% greater. Calculated plots of flux, adjoint flux, and weighting functions are included for three configurations of the facility. (auth)

### 3041 IDO-16250

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

REACTIVITY MEASUREMENT FACILITY MANUAL FOR INITIAL STARTUP. S. G. Forbes. Sept. 27, 1954. Decl. Aug. 30, 1955. 18p. Contract AT(10-1)-205. (MTRL-54-92)

To familiarize reactor personnel with startup procedure, this manual was prepared. Elements of the RMF control system are described and their function explained. Startup procedure is outlined. (D.E.B.)

### 3042 TID-5054

Brookhaven National Lab., Upton, N. Y.

SERIAL REPORTS ON START-UP EXPERIMENTS. NO. 6. THE CRITICAL EXPERIMENT. J. Chernick. Apr. 2, 1951. Decl. Aug. 10, 1955. 45p. Contract [AT-30-2-Gen-16].

The results of flux traverses of the BNL reactor during startup both below and above critical and of period measurements just above critical are presented. The data are used to determine the critical loading radius of the reactor; its Laplacian and migration area, lateral and axial reflector savings, normal flux distributions at different loadings; and to evaluate the effect of the central gap. The period measurements include all the data obtained with the galvanometer and with the control room counter at reactor loadings of 393 to 409 channels. (auth)

### 3043 TID-8003

Technical Information Service, AEC.  
GAMMA FACILITIES AT THE MATERIALS TESTING REACTOR. Brewer F. Boardman, Phillips Petroleum Co., Idaho Falls, Idaho. Jan. 1956. 3p. \$0.20(OTS).

One of its monograph series "The Industrial Atom."



Two radiation facilities, using gamma sources of spent MTR fuel elements immersed in a water shield, have been provided in a building adjacent to the Materials Testing Reactor. Fluxes up to 20 million roentgens per hour are available at a very nominal cost. Only basic health-physics instrumentation is provided as a part of the facilities. Additional test and measuring equipment must be supplied by the experimenter. Use of the gamma facilities is available on a first-come, first-served basis, and is authorized for experimental purposes only. (D.E.B.)

## PARTICLE ACCELERATORS

### 3044 AECU-3145

California. Univ., Los Angeles.

#### A TIMING CIRCUIT FOR THE UCLA FM CYCLOTRON.

Technical Report No. 24. Louis K. Jensen. Jan. 1956. 8p. Project No. NR022-053. Sponsored by ONR and AEC under Contract N6onr-275, Task Order IV. \$1.80(ph OTS); \$1.80(mf OTS).

A circuit has been constructed which supplies timing pulses for the various operating components of the UCLA f-m cyclotron as well as counter gating pulses of variable widths and adjustable positions on the cyclotron duty cycle. The pulses are timed relative to a master pulse generated when the cyclotron oscillator passes through a specified frequency in the direction of decreasing frequency, thus giving only one master pulse per duty cycle. Overall stability of the timing circuit is about one  $\mu$  sec. (auth)

### 3045 UCRL-3184

California. Univ., Berkeley. Radiation Lab.

#### STRONG-FOCUSING COCKCROFT-WALTON ACCELERATOR.

John M. Wilcox. Dec. 1955. 20p. Contract W-7405-eng-48. \$0.25(OTS)

The properties of a strong-focusing Cockcroft-Walton accelerator have been calculated. Permanent quadrupole magnets would be installed in each drift tube. It appears that the space-charge repulsion can be overcome so that the machine can accelerate a proton beam of 50 ma or more. (auth)

### 3046 UCRL-3218

California. Univ., Berkeley. Radiation Lab.

#### ION SOURCE FOR THE PRODUCTION OF MULTIPLY CHARGED HEAVY IONS.

Carl E. Anderson and Kenneth W. Ehlers. Dec. 19, 1955. 31p. Contract W-7405-eng-48. \$6.30(ph OTS); \$3.00(mf OTS).

A pulsed, cold-cathode ion source has been developed to produce multiply charged ions for use in a linear accelerator. Milliampere currents of such ions as  $\text{He}_4^{2+}$ ,  $\text{C}_{12}^{2+}$ ,  $\text{N}_{14}^{3+}$ ,  $\text{O}_{16}^{3+}$ ,  $\text{Ne}_{20}^{3+}$  and smaller currents of  $\text{S}_{32}^{5+}$  and  $\text{Ar}_{40}^{6+}$  have been produced in focused beams. Mass spectra of the various ionization states produced by the arc are presented. Constructional details of the source and the associated electronic equipment are given, and operating characteristics of the source and ion extraction are discussed. (auth)

## RADIATION ABSORPTION AND SCATTERING

### 3047 UCRL-3211

California. Univ., Berkeley. Radiation Lab.

#### SCATTERING MEASUREMENTS WITH POLARIZED PROTONS BETWEEN 141 AND 314 MEV.

Karl Strauch.

Nov. 26, 1955. 10p. Contract W-7405-eng-48. \$1.80 (ph OTS); \$1.80(mf OTS).

The purpose of this investigation is to determine the energy dependence of the polarization in proton-carbon scattering. A polarized proton beam, obtained by internal scattering in the 184-in. cyclotron at 13° from a Be target, was degraded, monitored, and scattered by suitable apparatus, and the scattered beam was detected in counters arranged so that the asymmetry could be measured at two different thresholds for elastic scattering. Polarization was determined at seven different energies from 141 to 314 Mev, at an angle of scattering near the maximum of polarization. (auth)

## SPECTROSCOPY

### 3048 ISC-622

Ames Lab., Ames, Iowa.

#### INFRARED DICHROISM STUDIES OF SOME MOLECULAR COMPLEXES.

R. D. Kross, K. Nakamoto, and V. A. Fassel. Dec. 16, 1955. 21p. Contract [W-7405-eng-82]. Charge \$3.30(ph OTS); \$2.40(mf OTS).

The results of a study on the polarized infrared spectra of the hexamethylbenzene-picric chloride, anthracene-sym-trinitrobenzene, and p,p'-dinitrodiphenyl-p-hydroxydiphenyl molecular compounds show agreement with published x-ray crystal structures. On the basis of the observed dichroism, molecular orientations are suggested for the complexes of picric acid with  $\beta$ -methyl naphthalene and piperidine. (auth)

## URANIUM AND URANIUM COMPOUNDS

### 3049 HW-39539

Hanford Atomic Products Operation, Richland, Wash.

#### MACROETCHING OF IRRADIATED URANIUM.

G. R. Mallett. Oct. 17, 1955. 6p. Contract W-31-109-Eng-52. \$0.10(OTS)

An electrochemical method, using a hydrochloric-phosphoric acid bath, has been developed which gives a good macroetch on uranium irradiated up to 1,550 MWD/AT. No special surface preparation is required unless the abrasive cut-off wheel produces burn marks on the cut surface. The burn marks can be removed by grinding with a 600 gritcloth prior to electrochemical etching. The sample is made the anode in the etching bath at a current density of 500 amps per square foot for 30 sec, then 50 amps/square foot for 10-30 min. To determine the necessary etching time, the etched surface may be observed at 10-min intervals. After etching, the sample is cleaned in nitric acid and rinsed in water. By rinsing immediately in ethyl alcohol, and then in n-octyl alcohol, the etch is preserved for two hr, allowing sufficient time for macrophotography work to be done before surface oxidation obliterates the etch. (auth)

### 3050 HW-40494

Hanford Atomic Products Operation, Richland, Wash.

#### A MODEL OF MECHANICAL BEHAVIOR EVALUATED WITH CREEP TESTS APPLIED TO ALPHA URANIUM.

K. R. Merckx. Nov. 17, 1955. 17p. Contract [W-31-109-Eng-52]. \$0.20(OTS)

A model for the mechanical behavior of a metal which considers the stress, strain, time, and temperature dependence of strain-rate is presented. The parameters



in the model are evaluated with creep tests. A series of creep tests for uranium are analyzed to give an equation of mechanical behavior for uranium. The method applied for uranium in the temperature range of 100 to 300°C but must be modified in the higher temperature ranges. (auth)

### 3051 AEC-tr-2374

EXPERIMENTAL RESEARCH ON MAGNETIC ROTATORY POLARIZATION. (Excerpts). Henri Becquerel. Translated by K. S. Bevis from *Ann. Chim. et Phys.* (5), 12, 1-87 (1877). 15p.

Excerpts pertaining to the study of uranium are presented. (B.J.H.)

Refer also to abstract 3002.

## PATENTS

### CHEMISTRY

#### 3052

PROCESSES OF PRODUCING URANIUM TRIOXIDE. C. E. Larson (to U. S. Atomic Energy Commission). U. S. Patent 2,723,181. November 8, 1955.

Uranium(VI) oxide, that may be readily converted to  $UCl_4$  by reacting with  $CCl_4$ , can be prepared by controlled calcination of  $UO_4$  at a temperature of 200 to 325°C, the  $UO_4$  having been thoroughly washed with an aqueous solution of  $NH_3$  after precipitation by  $H_2O_2$  from an aqueous solution of a uranyl salt. (auth)

#### 3053

CATION EXCHANGE SEPARATION PROCESS. French T. Hagemann and Harry C. Andrews (to U. S. Atomic Energy Commission). U. S. Patent 2,723,901. November 15, 1955.

The cation exchange separation of Ac from aqueous solutions and in particular its separation from a mixture also containing Th, Ra, Pb, Bi and bivalent decay "daughters" of Ra and Ac is described. This is accomplished by forming an aqueous mineral acid solution of the elements to be separated, passing the solution through a cation exchange resin whereby  $Ac^{3+}$  and  $Th^{4+}$  are completely adsorbed by the radium and other bivalent ions present are only partly adsorbed. The resin is then treated with a mineral acid, preferably the same acid as that used in the starting solution and also of approximately the same concentration, whereby the "partly" adsorbed elements are washed out, and thereafter using a more concentrated solution of mineral acid whereby the Ac is eluted while the Th remains on the resin. (auth)

#### 3054

MANUFACTURE OF URANIUM TETRACHLORIDE. M. J. Polissar (to U. S. Atomic Energy Commission). U. S. Patent 2,725,278. November 29, 1955.

A process is outlined for manufacturing  $UCl_4$  of high purity and of crystal size and structure in a vacuum apparatus comprising producing  $CCl_4$  vapor from a liquid source in a vaporizing chamber above a reaction chamber, introducing  $CCl_4$  vapor by gravity into the reaction chamber at 400 to 500° C. to react with  $UO_2$  or  $UO_3$  to product  $UCl_4$ , and returning unused  $CCl_4$  for recycling. (auth)

#### 3055

PREPARATION OF URANIUM HEXACHLORIDE. Ross E. Van Dyke and Ernest Charles Evers (to U. S. Atomic Energy Commission). U. S. Patent 2,725,279. November 29, 1955.

Uranium hexachloride has been produced by treating  $UCl_5$ ,  $UCl_4$ ,  $UO_3$ , or mixtures of two or more of these reactants with a mixture of liquid  $CCl_4$  and  $Cl_2$ . (auth)

#### 3056

APPARATUS FOR REACTING A DENSE CHLORINATING VAPOR WITH A SOLID. M. J. Polissar (to U. S. Atomic Energy Commission). U. S. Patent 2,725,284. November 29, 1955.

An apparatus is described for conducting a reaction between a vaporizable and a solid material comprising two communicating chambers of an hour glass configuration disposed along an inclined axis, the upper chamber forming a reservoir of vaporizable material, and the lower chamber being adopted for the solid material, a jacketed condenser extending in the upper chamber, a tube from the upper to the lower chamber to supply inert gas, a controlled discharge outlet into the condenser admitting the vaporizable material, a condenser vent, and a means of heating each chamber. (auth)

#### 3057

CONCENTRATION OF URANIUM ISOTOPES BY MOLECULAR DISTILLATION OF URANIUM POLY ALKOXIDES. A. K. Brewer, S. L. Madorsky and T. I. Taylor (to U. S. Atomic Energy Commission). U. S. Patent 2,727,000. December 13, 1955.

A method of partial separation concentrating isotopes of  $U^{238}$  and  $U^{235}$  in a molecular still is reported. Either uranium pentaethoxide or uranium penta normal propoxide may be used although the former is preferred as having greater thermal stability. The distillation is performed under a vacuum of between  $10^{-1}$  and  $10^{-3}$  mm of mercury. For uranium pentaethoxide a temperature of between 85 and 200° C.,  $U^{236}$  and  $U^{234}$  are separated by molecular countercurrent distillation from  $U^{238}$ , the latter being the enhanced residue. Uranium penta normal propoxide requires a temperature of between 100 and 210° C., again concentrating  $U^{238}$  in the residue and  $U^{236}$  with  $U^{234}$  in the distillate. (auth)

#### 3058

SYNTHESIS OF AN ALDOHEXOSIDE OF A FLAVONOL. S. H. Wender and C. H. Ice (to U. S. Atomic Energy Commission). U. S. Patent 2,727,890. December 20, 1955.

The synthesis of an aldohexoside of a flavonol is described. An acetohaloaldohexose is contacted with an alkali salt of the flavonol in liquid  $NH_3$ , and the aldohexoside is recovered from the resulting reaction mixture. Isoquercitrin is obtained by reacting the K salt of quercetin with acetobromoglucose in the described manner. (auth)

#### 3059

URANIUM-SILICON ALLOY AND PROCESS OF PRODUCING SAME. A. R. Kaufmann (to U. S. Atomic Energy Commission). U. S. Patent 2,731,341. January 17, 1956.

A process is outlined for fabricating soft ductile and corrosion resistant articles of U-Si alloys (15 to 20 at. % Si). The article is chill cast from the alloy and then heat treated for at least 10 hr at a temperature between 700 and 850°C. The phase diagram of U-Si alloy is described. (auth)



## ENGINEERING

## 3060

COMBINED ADJUSTING AND INDICATING MEANS. H. H. Obergfell (to U. S. Atomic Energy Commission). U. S. Patent 2,725,028. November 29, 1955.

A device that will move an object or objects with respect to a stationary assembly and accurately indicate the degree of relative movement, e.g. a condenser, is described. The object is moved longitudinally by a threaded shaft, turned by a suitable means, angular movement prevented by restraining means, a pointer, restrained longitudinally is permitted to rotate with the shaft about a dial, thereby showing amount of longitudinal movement imparted to the object. Another embodiment provides an indicator restrained longitudinally, that moves angularly and radially, this indicating a plurality of revolutions made by the positioning shaft, the radial movement of the indicator accomplished by cams. (auth)

## 3061

ELECTROMAGNETIC CENTRIFUGAL PUMP. K. O. Donelian and J. R. Menke (to U. S. Atomic Energy Commission). U. S. Patent 2,730,951. January 17, 1956.

An apparatus is described for pumping electrically conductive fluids such as alloys of Na and K by whirling the fluid within a pump chamber. The fluid is introduced into the center of a flat disk shaped chamber, where the interaction of a rotating magnetic field with the currents induced in the conducting liquid by the rotating field causes the fluid to follow a circular path at high velocity and then to be thrown outward by the resulting centrifugal force into an annular peripheral chamber from which the liquid exits through an outlet passage at the periphery. (auth)

## 3062

POLYPHASE VOLTAGE GENERATOR. B. H. Smith (to U. S. Atomic Energy Commission). U. S. Patent 2,731,590. January 17, 1956.

Development of a polyphase voltage generator having means for altering the angle between phases without varying the magnitude of the output voltages is reported. It is comprised of a single phase radio-frequency power supply, the output of which is utilized as the "A" phase of the polyphase system, and a pair of vacuum tubes having 45° sections of transmission line respectively connected between control grid and cathode and being respectively driven by 60° lagging, and 60° leading networks which are utilized as the "B" and "C" phases. Each of the 45° sections of transmission line is terminated in a potentiometer having a range of resistance value which includes a value equal to the characteristic impedance of the line. A property of such 45° sections of transmission line is that the magnitude of the input impedance remains constant for all values of terminating impedance while the phase angle does not. (auth)

## MINERALOGY, METALLURGY, AND CERAMICS

## 3063

RADIATION ANALYSIS. G. W. Morgan, O. M. Bizzell, G. C. Manov, and J. W. Hitch (to U. S. Atomic Energy Commission). U. S. Patent 2,722,609. November 1, 1955.

Techniques and apparatus were developed for determining the density of accumulated silt deposits on the bottom of

bodies of water, by measuring the bremsstrahlung radiation passing through a fixed distance, the intervening space comprising the silt deposits. The radiation detected is proportional to the density of the silt. The apparatus consists of a two pronged fork, one prong housing the radiation source, the other the detecting means. The fork is forced to the bottom of the body of water by a shaft and the density is measured on a count rate meter suitably located above the surface. (auth)

## 3064

METHOD OF PRODUCING BORON CARBIDE ARTICLES AND PRODUCT THEREOF. C. Sheer and J. Tittman (to U. S. Atomic Energy Commission). U. S. Patent 2,728,128. December 27, 1955.

The production of boron carbide articles is described. A plastic mixture of finely divided boron carbide and H<sub>2</sub>O is cold molded at pressures between 2000 and 20,000 lbs./in<sup>2</sup>, to produce the desired shape. The formed article is then removed from the mold, dusted with powdered carbon to prevent sticking and inhibit surface oxidation and baked in an atmosphere containing oxygen, e.g. air at a temperature of between 600 and 1000°C. By this process, between 10 and 20% of the boron carbide is oxidized to boron oxide and melted to form a vitreous binder for the remaining boron carbide. (auth)

## 3065

ELECTROPLATING ON BERYLLIUM. J. G. Beach and C. L. Faust (to U. S. Atomic Energy Commission). U. S. Patent 2,729,601. January 3, 1956.

The pretreatment of the Be surface for electroplating includes the following operations: anodically etch in H<sub>3</sub>PO<sub>4</sub> and HCl solution, chemically pickle in 70% HNO<sub>3</sub>, rinse with H<sub>2</sub>O, dip in aqueous (NH<sub>4</sub>)<sub>2</sub>SO<sub>4</sub>-H<sub>2</sub>SO<sub>4</sub> solution, and rinse in H<sub>2</sub>O. (auth)

## PHYSICS

## 3066

ARC SAFETY DEVICE FOR HIGH VOLTAGE POWER SUPPLY. R. P. Featherstone (to U. S. Atomic Energy Commission). U. S. Patent 2,723,371. November 8, 1955.

A protective control circuit is provided for a rectifier system which is used in conjunction with a high voltage alternating current supply system. It provides protection during the interim required for a circuit breaker to operate and will resume its protective control without the necessity of manual resetting by an operator. The circuit is essentially comprised of a thyatron tube, means for creating a voltage pulse for firing the tube in response to excessive current being drawn by the load, means for delivering the high intensity pulse derived from the firing of the thyatron to a triggering electrode which establishes an arc discharge between the triggering electrode and two line electrodes of a three phase system thereby preventing excessive currents from being rectified by the rectifier tubes. Abnormal current arising from the overload is prevented from immediately reaching the rectifier bank and the load. (auth)

## 3067

CALUTRON RECEIVERS. S. P. Frankel (to U. S. Atomic Energy Commission). U. S. Patent 2,724,058. November 15, 1955.

A delimitting vane type receiver for a calutron has been



developed. It takes advantage of the fact that ions of a given mass will have their orbits tangent to a common circle in the region of focus. It provides baffle means for intercepting other ions to pass to the collector. All vanes are located ahead of the 180° focal point. (auth)

### 3068

**CALUTRON RECEIVERS.** J. G. Backus (to U. S. Atomic Energy Commission). U. S. Patent 2,725,477. November 29, 1955.

An ion receiver for a calutron is designed to reduce the rebounding or "sputtering" of the high velocity ions from the pockets of the receiver. This is accomplished by a series of parallel pockets of a collector unit located within the receiver and adjacent an opening in the receiver for the ions. Rather than facing the elongated pockets parallel to the general direction of the ion beam at the focus point, the collector unit is rotated approximately 10°. This causes the ions to obliquely strike one wall of the pocket first rather than striking the end of the pocket as would occur if the pockets were parallel to the beam. Consequently, most rebounding ions strike the opposite wall and are retained rather than bouncing out. Each pocket is shaped to the cross sectional contour of the beam and a number are provided in a parallel arrangement so as to cover the entire spectrum presented by the beam. (auth)

### 3069

**APPARATUS FOR THE SEPARATION OF MATERIALS.** B. T. Wright (to U. S. Atomic Energy Commission). U. S. Patent 2,725,478. November 29, 1955.

The ion beam intensity in a calutron may be increased beyond the limit hitherto imposed by the strength and boundaries of the magnetic field by inserting auxiliary electrodes adjacent the accelerating electrodes which are maintained at a negative potential intermediate that of the accelerating electrodes and the grounded arc block of the ion source. A high potential may thus be applied to the accelerating electrodes to withdraw a copious supply of ions to form a dense beam. The beam is then reduced in speed by the auxiliary electrodes to a point where it can be appropriately deflected by a magnetic field of far less flux than would be required if the beam traveled at the speed imparted to it by high potential accelerating electrodes. Reducing the speed of the ions reduces rebound loss of ions at the collector and also serves to bar the flow of electrons toward the arc block from the liner and interior of the tank. (auth)

### 3070

**CALUTRON RECEIVERS.** W. E. Parkins (to U. S. Atomic Energy Commission). U. S. Patent 2,725,479. November 29, 1955.

A delimiting vane type receiver for a calutron has been developed. It operates on the principle that arcuate paths of ions of the same mass become internally tangent to a circular cylinder that is twice the diameter of the path followed by the ions. If the axis of this imaginary cylinder is coincident with the linear virtual focus of the beam at the source unit, the focus of the points of tangency, for given angles of divergence, will be a segment of the imaginary cylinder subtending angles to either side of the 180° focus position equal to the maximum angles of divergence of ions at the source unit. Vanes mounted within the receiver unit, are positioned at these points of internal tangency, immediately before and after the 180° focal point, so as to "shave"

the beam. This permits an enriched delimited portion of the beam to be passed into the collector. (auth)

### 3071

**CALUTRON SHIELDING.** J. R. Richardson (to U. S. Atomic Energy Commission). U. S. Patent 2,725,480. November 29, 1955.

Techniques have been found for completely removing the oscillating electrons that are customarily found in calutrons. This is accomplished by placing a grounded shield adjacent the positive potential ion source. The shield shapes the electric field surrounding the source in such a manner as to cause the undesirable oscillating electrons to migrate to a particular point. Here they come under the influence of another element and are discharged on the grounded shield. (auth)

### 3072

**CALUTRON RECEIVER.** S. W. Barnes (to U. S. Atomic Energy Commission). U. S. Patent 2,725,481. November 29, 1955.

An improved calutron receiver is described for a poly-isotopic ion beam operating in a shimmed magnetic field. It is comprised of a beam viewing face having a longitudinally curved slot therethrough, and structure within the receiver defining a plurality of ion collecting pockets. The pockets have a common wall between them which also divides the aforesaid longitudinal slot into two parts. This permits the pockets to be divided into two groups of elongated openings which converge in the general direction of the longitudinally curved slot. In this manner the walls of each elongated opening intercept the ions directed thereto at the smallest acute angle possible thus enabling a more efficient elimination of the "sputtering" problem. (auth)

### 3073

**POSITIONING DEVICE.** P. P. Smith (to U. S. Atomic Energy Commission). U. S. Patent 2,725,993. December 6, 1955.

Improvements on a device for charging bodies of fissionable material into a reactor without requiring a complete shutdown of the reactor or of the cooling system are reported. A means is provided to rotate and remove the tube closure plug, the exhausted slugs being otherwise removed. Fresh slugs, transported in a cylinder similar in principle to that of a revolver, are forced into place by a hydraulic ram; the ram is then withdrawn and the tube closure plug reinserted and rotated until locked. The escape of coolant fluid is prevented by a tight seal between the fuel tube and the positioning device. The device is remotely operated from a shielded position, and is transported vertically and horizontally by an elevator. (auth)

### 3074

**CALUTRON RECEIVERS.** S. W. Barnes (to U. S. Atomic Energy Commission). U. S. Patent 2,726,336. December 6, 1955.

A calutron receiver has been adapted to efficiently separate the isotope components of a shimmed ion beam. Modification of the magnetic field by the use of shims causes a relative shifting of the foci along the general direction of travel of the beam at the 180° region of focus. This invention compensates for this relative shift by utilizing a receiver having a beam viewing face disposed at an acute angle with a plane normal to the general direction of travel of the beam at the 180° region of focus. This permits the receiver viewing face to pass through the most intense



portions of the foci of the beam thereby increasing the separation efficiency. Means for adjusting the receiver and beam to a position of optimum focus together with means for blocking off the beam and cooling the receiver are also disclosed. (auth)

### 3075

**CONCRETE RADIATION SHIELDING MEANS.** L. B. Borst (to U. S. Atomic Energy Commission). U. S. Patent 2,726,339. December 6, 1955.

The shielding efficiency of a concrete shield to emanations from radioactive substances, particularly neutrons and gamma radiations, has been increased by the random inclusion in the matrix of small masses of free elements having a specific gravity of over 6.5, for example, pellets of Fe, Pb, Cr or Ni, and compounds such as colemanite or limonite, the weight of the added material varying between  $\frac{2}{3}$  and  $\frac{3}{4}$  of the total weight of the matrix. The increased shielding effect permits a reduction of 30 to 40% in the thickness of the shielding. (auth)

### 3076

**ION PUMP.** E. O. Lawrence and J. S. Foster, Jr. (to U. S. Atomic Energy Commission). U. S. Patent 2,726,805. December 13, 1955.

Large volumes of gas at very low pressures can be electromagnetically pumped by ionizing the gas and causing the ions to move to a remote position where they are neutralized and retained. The ions are formed by introducing the gas into the central portion of a space containing an elongated magnetically collimated arc discharge where they are created at the center of the arc discharge and urged toward the ends of the arc by virtue of the potential gradient which exists. The ions are then collected at the ends of the arc by the cathodes in such a manner that any gas not retained diffuses back into the arc wherein it is again re-ionized and returned to the cathodes. The pump of this design has a very high pumping speed and is capable of attaining a vacuum of  $10^{-7}$  mm of mercury. (auth)

### 3077

**CALUTRONS.** E. O. Lawrence (to U. S. Atomic Energy Commission). U. S. Patent 2,727,150. December 13, 1955.

A calutron transmitter having an ion source at a high positive potential with respect to the calutron tank is modified to minimize the high voltage current drain to reduce wear and erosion of the electrodes. This is achieved by minimizing the volume of the electric field surrounding the ion source in which electron oscillation may occur, thereby reducing the total path traversed by the oscillating electrons and thus decreasing the overall ionization through the gaseous region immediately surrounding the ion source. The structure for accomplishing this is comprised of an electric shield surrounding the ion source having a concavity formed in opposing walls thereof, a second electric shield disposed between the first electric shield and the ion source and having a pair of opposing fins extending therefrom into the concavity and substantially normal to the magnetic field. (auth)

### 3078

**CALUTRON RECEIVERS.** W. E. Parkins (to U. S. Atomic Energy Commission). U. S. Patent 2,727,151. December 13, 1955.

An ion receiver is adapted to be placed in the target region of a calutron for collecting selected ions at less than their full energy after they have been subjected to one or more deceleration steps within the receiver. The re-

ceiver contains a vane system disposed adjacent the region of focus for intercepting a portion of the beam while passing the remainder beyond the region of focus. Ion decelerating means are then disposed in the path of the remainder of the beam beyond the region of focus for further deceleration. A collector is disposed in the paths of these decelerated ions for further decelerating and collecting of the selected ions, the collector being positioned so as to be substantially free from bombardment by de-ionized beam particles which are scattered from the beam decelerating means and other components. In this manner only selected portions of a polyisotopic ion beam having a high factor of enhancement with respect to a desired isotope are collected. (auth)

### 3079

**CALUTRON RECEIVER.** S. W. Barnes and W. M. Brobeck (to U. S. Atomic Energy Commission). U. S. Patent 2,727,152. December 13, 1955.

A calutron receiver is described for receiving a plurality of non-interfering, intersecting, magnetically shimmed beams of singularly ionized uranium ions for separately collecting a portion of each beam enriched with respect to the  $U^{235}$  isotope and impoverished with respect to the  $U^{238}$  isotope. Provision is made for the ready adjustment of the spacing between the receivers and independent adjustment of each receiver in a direction along the general path of travel adjacent its region of focus of the beam to be received. Means are also provided for reducing contamination of the material collected from one beam by the scattered material from an adjacent beam after it strikes an adjacent receiver. (auth)

### 3080

**RADIATION DETECTOR.** W. W. Goldsworthy (to U. S. Atomic Energy Commission). U. S. Patent 2,727,154. December 13, 1955.

The detector permits the counting of incident alpha particles only, beta and gamma particles only, or all three types of particles. A counter is arranged to register impulses from a photomultiplier tube in conjunction with an amplifier to establish a threshold of impulse strength which will register the counter. A lucite light conductor leads from the photomultiplier tube to a window and cap holding two scintillating crystals therein. The first crystal, e.g. zinc sulphide, is highly sensitive to alpha particles. The second, e.g. stilbene, being somewhat less sensitive is responsive to beta and gamma particles. The alpha particles do not reach the second crystal as they are stopped in the first crystal, thus by adjusting the amplifier gain only the scintillation from the alpha products may be counted, or by increasing the gain all three particles may be counted. By substituting a similar cap having the first crystal opaque to alpha particles, the second crystal sensitive to beta and gamma particles, the latter impulses may be counted. In this manner, a selective counting is accomplished; space is provided for storing the substitute cap; and the complete device is portable. (auth)

### 3081

**CALUTRON.** W. M. Powell (to U. S. Atomic Energy Commission). U. S. Patent 2,727,190. December 13, 1955.

In setting up the field required in calutrons, the magnetic coils are arranged to provide generally rectangular core openings, which in the case of large magnets may be subdivided by suitable horizontal and vertical partitions into a plurality of smaller generally rectangular openings.



A plurality of identical structural elements are provided which may be stacked in assembled relation to fill these openings, and these elements are shaped so as to be self-sustaining, to provide a plurality of spaced apart strips extending from edge to edge of the magnet and to provide a substantially continuous flat pole face for the magnet. The structural elements are conveniently formed as castings in the shape of long, shallow trays, the ends of which provide the stacking surfaces, the bottoms of which provide the spaced apart strips, and the sides of which provide the pole face. (auth)

### 3082

LEAK DETECTOR. R. Loevinger, T. A. Chubb, and G. W. Monk (to U. S. Atomic Energy Commission). U. S. Patent 2,727,995. December 20, 1955.

A leak detector is described using He or other appropriate gas for the detection of leaks in tanks, housing, or other equipment where it is necessary to know the effectiveness of the seal or air tightness thereof in connection with maintaining vacuum or pressures therein. If He is used as the gas, it can only enter the detector through the sealed chamber to be tested thus providing an indication of any leak. Any such He molecules entering the detector are ionized by means of a cold cathode ionization chamber. The ions are then accelerated into a region of lower pressure where they are caused to follow arcuate paths thus providing an ion beam. A charged electrode is displaced from the ionization chamber along the arc of travel of the ions at substantially the focal point of the beam in order to suppress the ions of low energy content. A collector is disposed beyond the focal point on the arc of travel of the ions for collecting the high energy ions. The important feature of this invention is the provision of the suppressor electrode which operates to permit only the He ions to reach the collector. (auth)

### 3083

THERMAL NEUTRON SHIELD AND METHOD FOR MAKING SAME. T. Rockwell, III, and V. L. McKinney (to U. S. Atomic Energy Commission). U. S. Patent 2,727,996. December 20, 1955.

An improved thermal neutron reactor shield of low weight and bulk, suitable for use aboard planes, ships and the like has been developed. The shield comprises a continuous matrix of a malleable metal such as Al or Zr, dispersed in which is a refractory material, boron oxide or boron carbide, in powder or pellet form, and a sheathing of Al or stainless steel bonded thereto. The matrix is sandwiched between the sheathing in a high temperature rolling process. The B content of the matrix may vary between 35 and 50%. A shield as described  $\frac{1}{4}$  in thick will alternate a neutron of .025 ev energy. (auth)

### 3084

VIBRATION MEASURING APPARATUS. M. J. Willner (to U. S. Atomic Energy Commission). U. S. Patent 2,728,220. December 27, 1955.

An apparatus for measuring the amplitude of oscillation of a vibrating body, regardless of the frequency is described. A light source and lens are combined to project a narrow line of light. A plaque of uniformly varying reflectivity, i.e. a photographic film of varying density or a triangular mirror is attached to the vibrating body in such a manner that the aforesaid light beam is reflected to a photoelectric cell. The vibration of the body will vary the produced current of the photocell proportional

to the amplitude of vibration. The modulated current may be amplified and recorded. (auth)

### 3085

HIGH VACUUM DISTILLATION APPARATUS. S. L. Madorsky (to U. S. Atomic Energy Commission). U. S. Patent 2,728,717. December 27, 1955.

A cascade arrangement of molecular stills comprising columns, feed reservoirs, and associated conduits and flow regulators to separate liquids of slight variation in volatility has been operated. Each column contains a heated surface, means to flow liquid into a thin film thereover and a cooled condensing surface. The distillate from each column is introduced in the reservoir of the next higher column except for the last column from whence the distillate may be drawn off or recycled through the cascade. The residue from each column is piped to the residue of the next lower column, thereby being recycled, except for the first column where it is reintroduced to the first reservoir. There is a controlling means for regulating the flow to the column from its associated reservoir. (auth)

### 3086

RADIATION POCKET SCREAMER. F. M. Glass (to U. S. Atomic Energy Commission). U. S. Patent 2,728,861. December 27, 1955.

The portable and compact radiation monitor which provides a warning signal, if a predetermined amount of radiation has been received by the bearer, employs an ionization chamber attached to the control grid of a thermionic tube. The potential on the grid of the tube is adjusted below the cut-off point. The charge placed on the chamber and the capacity thereof are so inter-related with the characteristics of the thermionic tube that a predetermined critical total amount of radiation falling upon the chamber will raise the grid potential of the tube to the point where the tube will begin to conduct. At this point an alarm is made to operate by a relaxation oscillator circuit connected to the anode of the tube. The oscillator includes a gas discharge tube shunted by a crystal transducer, which serves the dual purpose of a condenser for inducing oscillation in the gas discharge tube and a transducer for producing an audible signal responsive to the oscillations it induces. (auth)

### 3087

GENERATION OF POWER. V. C. Wilson (to U. S. Atomic Energy Commission). U. S. Patent 2,728,867. December 27, 1955.

Techniques and apparatus are proposed for using a reactor as a source of high voltage or electrical power by means of the  $\beta$  rays from a reactor. The device includes collecting means in close proximity to the fissionable bodies in a reactor so that  $\beta$  rays may be conducted externally through terminals as electrical energy. The fissionable bodies of a reactor are surrounded by cylindrical  $\beta$  ray collectors of Cu, Al, Be or other suitable electrical conductors having a neutron absorption cross-section with a danger sum below about 50. The space between the collector and a fissionable body serving as suitable insulation may be evacuated to secure optimum insulation, employing insulation such as quartz, mica, polystyrene, etc. (auth)

### 3088

POLARITY SELECTOR. R. G. Hester (to U. S. Atomic



Energy Commission). U. S. Patent 2,729,809. January 3, 1956.

A polarity selector circuit is adapted to receive and sort electrical events by electrical impulses. It includes means for scanning a record medium and producing binary electrical signals in accordance with the recorded information, and means for differentiating between the character of the signals produced. (auth)

#### 3089

SWEEP CIRCUIT. G. B. Andrews, R. L. DeVoll and W. X. Lamb, Jr. (to U. S. Atomic Energy Commission). U. S. Patent 2,729,815. January 3, 1956.

A sweep circuit for displaying, in one sweep and in expanded form, two pulses which may be separated by a considerable period of time is described. The circuit operates by partially sweeping an oscilloscope beam in a horizontal direction during transmission of a pulse from a central station, cutting of the sweep during the time that the pulse is traveling to a distant object and back to the central station and continuing the sweep from its interrupted position just prior to and during the time that the pulse is being received at the central station, thus permitting transmitted and received pulses to appear adjacent to each other in expanded form on the face of the oscilloscope. (auth)

#### 3090

RADIATION DETECTION DEVICE. G. Failla (to U. S. Atomic Energy Commission). U. S. Patent 2,731,568. January 17, 1956.

A small, low cost device that indicates the presence or degree of ambient radioactivity and does not depend upon an electrical source for operation is described. A number of identical glass or amber balls are contained in a

dielectric container shaped so as to cause the balls normally to congregate. An atmosphere of a dry ionizable gas is present. Upon shaking the container the induced tribo-electric charges cause the balls to disassociate. If no radiation is present, this effect will continue, but a sufficiently high level of radiation will ionize the gas thereby permitting the tribo-electric charges to leak off and the balls to reaggregate. The level of radiation necessary is determined by the size of the balls, the larger sized balls being more reluctant to disassociate and quicker to reaggregate thus indicating a lower level of radiation. (auth)

#### 3091

ELECTROMAGNETIC ROD-POSITION INDICATOR. D. Krucoff (to U. S. Atomic Energy Commission). U. S. Patent 2,731,624. January 17, 1956.

An instrument is described for indicating the position of an elongated movable element enclosed within a sealed housing wherein the indicating device has neither mechanical nor electrical connections traversing the sealed housing. The movable element is comprised of three sections. The outer two are made of material having magnetic permeabilities at least ten times that of air whereas the intermediate portion connecting the outer two portions has a magnetic permeability equal to that of air. Three electro-magnets are mounted outside the elongated housing in which the movable member is slidably disposed. Means are provided for measuring the relative magnitude of the electrical currents flowing through the series connected windings of the first and second electro-magnets and the current flowing through the winding of the third electro-magnet which is an indication of the position of the movable element. (auth)

## NOTICE

It has been necessary to omit the Author Index and Numerical Index of Reports usually included in this issue. Cumulated indexes for Vol. 10, Nos. 1-12A, will appear in No. 12B, dated June 30, 1956.



